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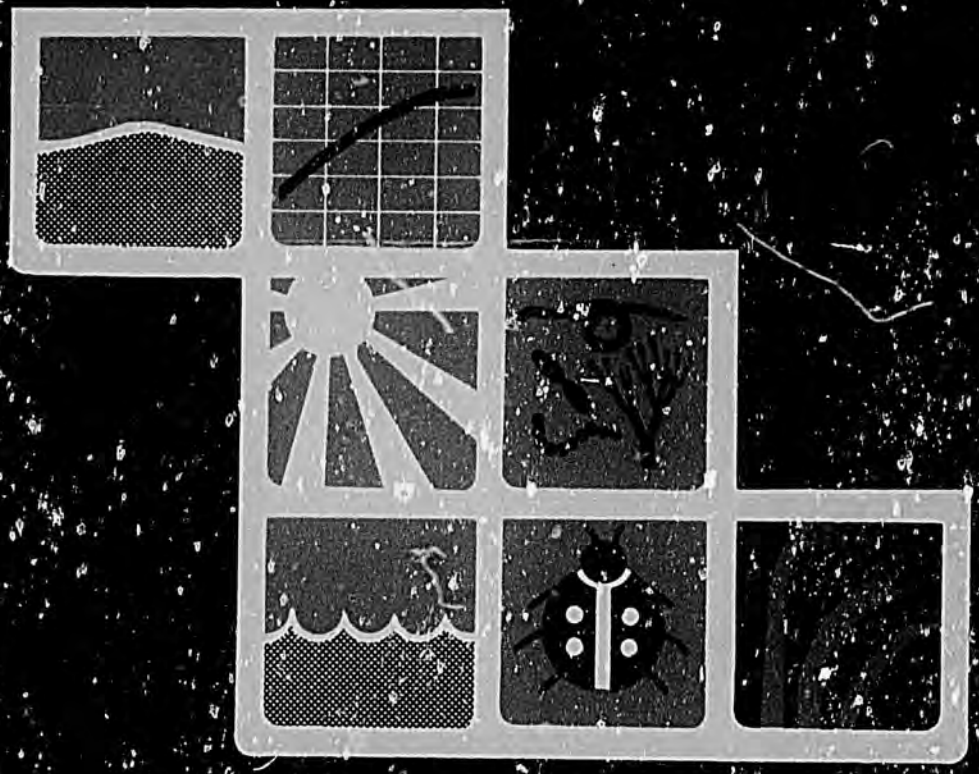

ENVIRONMENTAL ADAPTATION OF CROPS

PHILIPPINE COUNCIL FOR AGRICULTURE
AND RESOURCES RESEARCH AND DEVELOPMENT
National Science and Technology Authority and the
SOIL MANAGEMENT SUPPORT SERVICES
SOIL CONSERVATION SERVICE
United States Department of Agriculture

OFFICE OF THE EXECUTIVE DIRECTOR

To our valued reader,

This publication presents in consolidated form the environmental adaptation of crops which are commonly grown or have economic potentials in the country.

Likewise, it contains various information on the different environmental factors presented in tabular form. Under each factor, the crops are arranged in alphabetical order for easy reference.

This handbook is co-published by PCARRD and the Soil Management Support Services (SMSS), Soil Conservation Service of the United States Department of Agriculture. It hopes to supplement the Philippines Recommends series and other extension-type publications of PCARRD designed as guides in crop production and management.

We will update this publication whenever additional information is gathered or more appropriate technologies are generated by the research system.

Sincerely yours,

RAMON V. VALMAYOR
Executive Director

. . . . . .

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C

Foreword

Matching site conditions to crop requirements is a critical step in our efforts to sustain or increase crop production. In the past, we have followed rules of thumb and developed guidelines. Today, with the advent of rapid computers and the proliferation of crop simulation models, there is a need for more specific information. However, such information is not readily available for most crops and the requirements may vary with different cultivars as many have been bred to withstand specific threshold conditions.

This handbook on "Environmental Adaptation of Crops" attempts to compile the more recent information on crop requirements. A compendium of this type cannot necessarily be complete in any one area. The objective is to search published literature and report the opinions of authors on crop requirements. Consequently, the compendium is not critical either but hopefully presents the state of knowledge.

Crops and cultivars are identified by their botanical names and are therefore unambiguous. However, soils and sites are less specifically described. One of the recurrent problems encountered while compiling this compendium is that, as a rule, the soil and site were seldom described. At present, more agronomists are paying attention to site conditions using soil taxonomy to classify the soils. We hope in the near future to prepare a similar monograph where soil and site conditions are better defined.

RAMON V. VALMAYOR
Executive Director
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Project Leader
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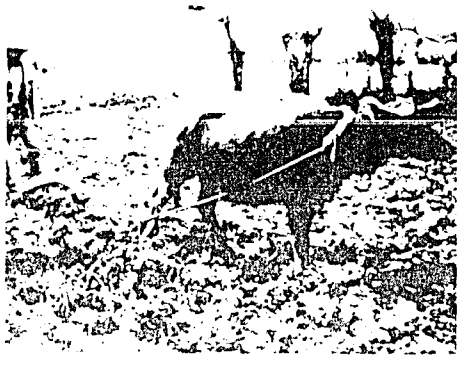
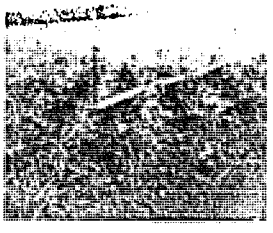
Symbols and Abbreviations

BPI — Bureau of Plant Industry
°C — degree Celsius
cm — centimeter(s)
ft-c — foot-candle(s)
ha — hectare(s)
IPB — Institute of Plant Breeding
IRRI — International Rice Research Institute
kg — kilogram(s)
klux — kilolux
L — liter(s)
lb — pound(s)
m — meter(s)
m^3 — cubic meter(s)
max — maximum
min — minimum
NFAC — National Food and Agriculture Council
PCA — Philippine Coconut Authority
UPLB — University of the Philippines at Los Baños
tsp — teaspoon(s)
wk — week(s)
yr — year(s)



Introduction

Environment tremendously influences the kind of crops grown, management practices, cropping pattern, and level of inputs needed for economic yields. A crop performs best and is least costly to produce if grown under the most favorable environmental conditions. In crop production, therefore, a grower must consider the environmental factors which influence plant growth and development to get high yields and maximum profit.

Crops have different morphological and physiological characteristics. As such, they respond differently to a given set of environmental conditions. Rice, for example, grows best under waterlogged conditions while papaya cannot withstand waterlogging even for a day. Although crops generally prefer fertile soils, there are crops which can perform well even under conditions of low fertility.

Cropping patterns commonly practiced at present are largely based on rainfall distribution and availability of irrigation water. In areas with distinct wet and dry seasons, for example, the wet season crop, which is rice, is followed by a drought-tolerant crop like mungbean. Where water is available all year round, even three successive crops of rice are grown. Another factor to consider in devising a crop-

ping pattern is susceptibility to pests and diseases. From the standpoint of crop protection, it is a wise practice to avoid growing in succession crops which succumb to the same pest or disease.

A crop is more expensive to produce if the area and climatic conditions are not favorable to it. This additional expense may be in the form of soil amendments, pesticides, and management practices. In some cases, crop production may be economically feasible under less favorable environmental conditions, but the risks and production costs are high. Yield and quality are also adversely affected.

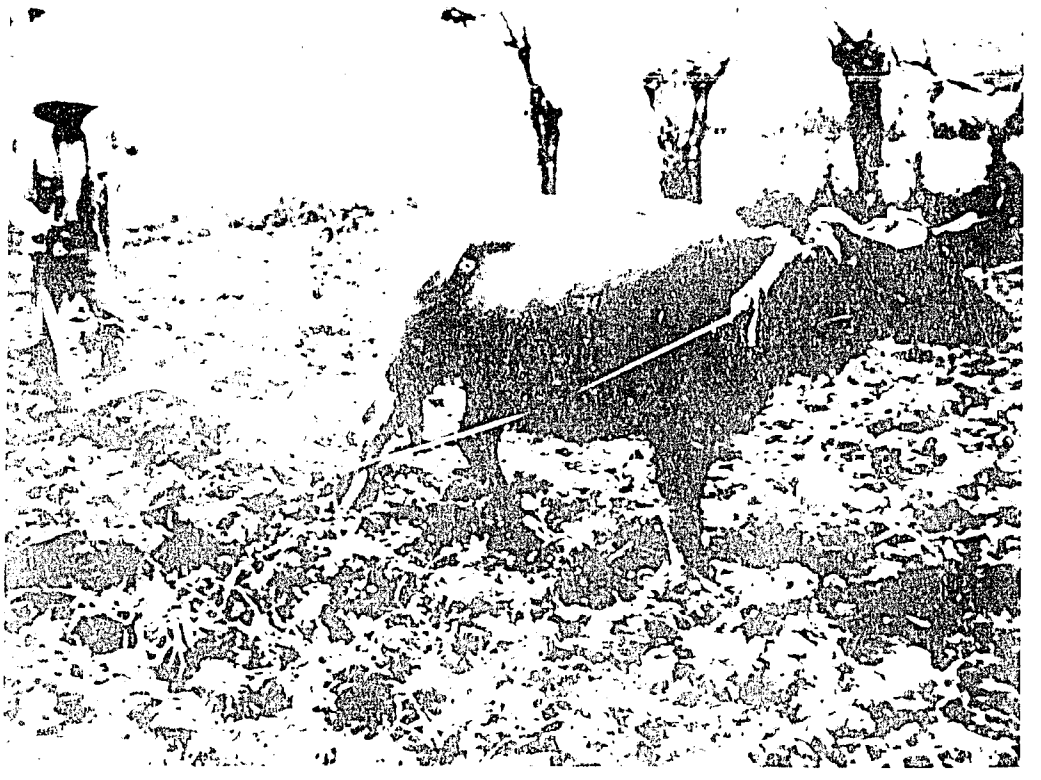
To some extent, a crop or variety can be modified or improved to suit a particular environment, but this approach requires considerable time and resources. On the other hand, the micro-environment of the crop can also be modified but this entails additional cost. In some instances, it may even increase the cost of production to such extent that the production of the crop is unprofitable.

This handbook presents in consolidated form the environmental adaptation of crops which are commonly grown or have economic potentials in the country. Seven environmental factors influencing crop growth and development are considered: soil, temperature, light, water, diseases, insect and mite pests, and weeds. The handbook is designed as a guide in determining the crops to grow in a particular area, when to grow them, soil and water management practices required, expected insect pest, disease and weed problems, and their control measures.

It hopes to supplement the Philippines Recommends series and other extension-type publications of the Philippine Council for Agriculture and Resources Research and Development (PCARRD) designed as guides in crop production and management.

Various information on the different environmental factors are presented in tabular form. Under each factor, the crops are arranged in alphabetical order for easy reference. Information on most crops is by no means complete. This should serve as a challenge to plant scientists to direct their efforts in filling the research gaps.

PCARRD intends to update this publication whenever additional information is gathered or more appropriate technologies are generated by the research system. Towards this end, readers are requested to give feedback suggestions that will update or improve its contents.



Soil

The soil is the basic medium for plant growth. It provides anchorage for the plant. It also supplies water and mineral nutrients necessary for normal growth and development. A crop performs best when grown under a suitable soil environment. Thus, selecting the right kind of soil is important for successful and profitable crop production.

Soil properties commonly considered in soil selection are texture, structure, pH, and fertility. The texture determines the capacity to store water and nutrients, aeration, drainage, and ease of field operations. Coarse-textured soils are easily tilled, well-drained, and aerated but usually have low fertility and water holding capacity. Fine-textured soils, on the other hand, are more fertile and have high water retention but are poorly drained and aerated.

The soil structure influences porosity, aeration, water movement, and root penetration. Undesirable physical properties of fine-textured and coarse-textured soils can be offset by improving the soil structure.

Soil pH affects the plant indirectly by influencing the availability and effect of nutrients and the activity of microorganisms. Crops have pH preferences and would grow best if planted in soils that satisfy their pH requirements.

In this section, the soil texture/structure requirements, soil pH tolerance, nutrient removal, fertilizer recommendations, and salt tolerance of various crops grown in the Philippines are presented. In Table 1, crops are grouped according to their soil texture requirements, whether moderately coarse, medium, moderately fine, or fine. It shows that the majority of the crops prefer moderately coarse to moderately fine-textured soils (sandy loam to clay loam). Only rice and taro grow best on clay soils. Little or no rice is grown on coarse textured soils because of poor water retention.

Specific soil requirements and responses of crops under less suitable soil conditions are indicated under "Remarks." Although a crop is grouped under a particular textural range, it does not mean that high yields can only be possible within that range. Medium-textured soils are considered best for growing root crops. However, even those usually considered rather exacting in their soil requirements can be successfully grown on a wide range of soil types. The groupings merely indicate the most suitable textural class for each crop when other growth factors are not limiting. In areas where soil moisture is limiting and the temperature is high, it is advantageous to grow the crop in fine-textured soils even if coarse-textured soils are most suitable under normal conditions. Also, the undesirable characteristics of other textural classes can be partially offset by the amount and distribution of rainfall, management practices, and good soil structure. Organic matter plays a major role in soil structure as well as water retention.

Table 2 presents the pH tolerance of various crops grown in the country. Although most crops perform well within a wide range of pH values, percentage reduction in yield increases as the soil pH approaches the lower and upper tolerance limits. Whenever available, the optimum pH (range) is also included to indicate the most favorable for maximum yield. A pH of 6.5 is considered ideal for most crops since soil fertility problems are least observed at this pH level. The majority of Philippine soils are acidic, hence liming may be necessary to produce high yields. When to apply lime must be based on the pH requirement of the crop and the expected returns that could be derived from liming.

Table 3 presents the extent of nutrient removal by some crops. It indicates the nutrient needs of the crop that have to be met from fertilizers and the soil. It also indicates the nutrients most needed by the crop. Legumes, however, need only a light dressing of nitrogen despite their high uptake for it, since they can obtain their nitrogen requirements from the atmosphere through symbiotic nitrogen fixation. The nitrogen fertilizer recommended for legumes at planting is used to obtain rapid initial growth of the plants. Crops grown for their vegetative parts, like leafy vegetables, remove much nitrogen from the soil thus nitrogen is vital in the production of these crops. Crops grown for starch and sugar have a high demand for potassium thus yield is adversely affected when this nutrient is limiting.

Fertilizers recommended (Table 4) are the general recommendations for various types of soil found in the country. They are presented as guides in determining the amount of nitrogen, phosphorus, and potassium to apply to different crops when the fertility status of the soil is not known. The optimum fertilizer level, however, depends on the response of the variety, native soil fertility, and relative prices of fertilizers and the produce. Results of the soil tests and fertilizer trials should be considered in making the necessary adjustments to eliminate guess work. Applying fertilizers without knowing soil nutrient levels can prove costly.

Table 5 presents the salt tolerance of some crops. Salt tolerance is based on the relative yield of a crop on a saline soil compared to its yield on a nonsaline soil under similar growing conditions. Within each crop group, crops are listed in the order of decreasing salt tolerance but a difference of two or three places in a column may not be significant. Salt tolerance of crops grown in the country has limited information, and from available data, very few economically important crops have high tolerance to soil salinity.

Table 1. Soil texture requirements of crops grown in the Philippines

Crops Requiring	Remarks	References
Moderately coarse texture soils (sandy loam, fine sandy loam)		
Banana	Best soils are deep and friable loams with good drainage and aeration.	Anonymous (1974)
Cashew	Can grow on poor or stony soils. It performs best on deep, friable, well-drained sandy loam soil without a hardpan. It does not grow well on heavy clays, poorly drained soils, and areas with brackish subsoil.	Ohler (1969; 1979)
Cassava	Grows best on sandy or sandy loam soils. It performs satisfactorily on any type of soil provided it is well-drained, not saline, and waterlogged. On heavy clay soils, the plant produces stem and leaf growth at the expense of the roots thus many cultivars give poor yields.	Kassam (1976) Kay (1973)
Chico	Best soil is a rich well-drained sandy loam. It also thrives almost equally well on clay or shallow sandy soils underlain with soft limestone.	Coronel (1976)
Coconut	Prefers well-drained soil permitting free root development and aeration. It does best on alluvial and sandy soils near the coast. Relatively salt resistant. Soil must be reasonably deep (over 90 cm deep) without a hardpan or a high water table.	Godin and Spensley (1971) Murray (1977) Lambert (1970)
Kenaf	Prefers well-drained sandy loam soil. It cannot tolerate waterlogging areas.	Kassam (1976)
Peanut	Needs friable soil so that the peg can easily penetrate and develop in the soil. It can be grown on loamy sand to clay loam soils but sandy loam soils are best. Avoid rocky fields,	Hill (1952) Agdeppa and Millares (1972) Rachie and Roberts (1974)

Table 1. (Continued)

Crops Requiring	Remarks	References
	those with shallow top soil, heavy clay or poorly drained areas.	
Potato	Can be grown on all types of soils, except heavy waterlogged clays. A deep, well-drained loam, or sandy loam is considered best.	Kassam (1976)
Radish	Will grow on moist soils but a rich sandy loam is preferred. Clayey soils tend to produce misshapen roots.	Kay (1973)
Sesame	Prefers sandy loam soils; must be well-drained but capable of adequate water retention. It does not do well on waterlogged or acid soils, or on shallow soils with impervious subsoils.	Kassam (1976) Godin and Spensley (1971)
Sweet potato	There is better balance between growth of vine and root yield on well-drained sandy or silt loam. Heavy clay results in growth of stems and leaves but not tuberous roots which are poorly shaped.	Hahn (1977) Minges and Morris (1953)
Yam bean	Sandy loam soil with adequate drainage is essential. It cannot stand heavy, waterlogged soils.	Kay (1973)
Medium textured soils (very fine sandy loam, loam, silt loam, silt)		
Arrowroot	Deep, well-drained loam soils give best results. When grown on light soil, a degree of shade has been found to be beneficial. Badly drained and heavy clay soils are not suitable.	Kay (1973)
Avocado	Can be grown successfully on a wide range of soil types. Deep, fertile, well-drained soils, particularly sandy or alluvial loams are best. Heavy soils or those with a high water table are not suitable.	Coronel (1978)
Black pepper	Grows on many types of soil, but deep, well-drained soil rich in organic matter is best.	Anunciado (1969)

Table 1. (Continued)

Crops Requiring	Remarks	References
Carrot	Needs deep and friable soil.	Tisbe (1967)
Citrus	Adapted to a wide range of soil types provided they are reasonably deep and aerated but have high moisture retention. Extremely porous or water-logged soils are not suitable. Sticky heavy soils, wet soils, and those underlain with hardpan should not be used.	Reuther (1977) Hume (1957) Parker (1948) Platt (1973)
Coffee	Needs deep, well-drained loam soil. Clays are not good. Soil should be rich in nutrients especially potassium with an ample supply of humus.	Wellman (1961)
Cole crops (cabbage, cauliflower, Chinese cabbage)	Can be grown on a wide range of soils. Fertile, deep, well-drained sandy and silt loams are best. It can also be grown successfully on clay loam soils.	Minges (1977) Thompson and Kelly (1957)
Common bean	Grows well on a wide range of soils. Well-drained and reasonably fertile soil is best. The soil should be friable and should not interfere with emergence.	Meiners and Kraft (1977)
Corn	Can grow on almost all soil types (sandy loam, silt loam, clay loam) provided they are well-drained. Avoid extreme soil types (light sandy or gravelly soils and heavy clays) which are not conducive to the development of healthy roots.	Thompson and Kelly (1967) Gaudiel and Aquilizan (1967) Jacob and Uexkull (1960)
Cotton	Can be grown on a variety of soils but loam soils are preferred. Good drainage and aeration are important. Shallow usually stony soils, poorly drained soils, very sandy soils, and clay pan soils are poorly suited. Top soil must have high water holding capacity.	Kassam (1976) Brown and Ware (1958) Jacob and Uexkull (1960)
Durian	Thrives best on sandy or loamy soils where aeration is good. The site should not have tendency to flood, or to remain too dry for long periods.	Malo and Martin (1979)
Eggplant	Best adapted to fairly fertile, well-drained loams. It grows on sandy soils and heavy clays where its roots are often waterlogged.	Martin and Pollack (1979)

Table 1. (Continued)

Crops Requiring	Remarks	References
Garlic	Needs friable, fertile, well-drained soil but a good moisture supply during the growing period should be maintained. Any type of soil where onions grow would be satisfactory for garlic.	Deanon and Cadiz (1967)
Ginger	Requires well-drained, loamy soils with a fairly retentive clay subsoil at a depth of 30-45 cm.	Groszmann (1954)
Grapes	Fertile, deep, and well-drained loam soils are best. Generally, planting on moderately well-drained clay loam is better than on sandy soil.	Pantastico, *et al.* (1976)
Lettuce	Requires well-drained, sandy loam to clay loam soil. Good content of organic matter is desirable.	Bantoc (1967)
Lima bean	Grows best on light textured well-drained soils.	Meiners and Kraft (1977)
Okra	Tolerates a wide range of soil conditions. It cannot tolerate poor drainage. It is susceptible to nematodes frequently found in sandy soils.	Martin and Ruberte (1978)
Onion	Needs friable, fertile, well-drained soils but maintain a good moisture supply during the growing period. It does not perform well in heavy soils like clay or clay loam.	Deanon and Cadiz (1967) Thompson and Kelly (1957)
Pepper	Can be grown on any soil although it prefers a fertile loamy soil. It will not grow well if its roots are constantly flooded.	Martin, Santiago and Cook (1979)
Pineapple	Can be grown on many types of soils provided these are well-drained and aerated. It cannot tolerate waterlogged soils. Medium to heavy loams well-supplied with humus are most suitable.	Collins (1960) Iznaga and Tabayoyong (1968)
Tannia	Can be grown on a wide variety of soils except hard clays or pure sands. For optimum yield, deep, well-drained, rich soil is required. Unlike taro, tannia is very sensitive to waterlogging and saline conditions.	Kay (1973) Kassam (1976)

Table 1. (Continued)

Crops Requiring	Remarks	References
Tobacco	Generally requires deep soil with reasonable moisture holding capacity, free drainage, and a relatively open, loose structure.	Akehurst (1968) Garner (1951)
Burley	Grows most successfully on highly productive silt loam soils well-supplied with organic matter.	Garner (1951)
Cigar filler	Requires distinctly heavier soils than cigar wrapper (loam to clay loam).	Garner (1951) Akehurst (1968)
Cigar wrapper	Performs best on sandy loam, fine sandy loam, or very fine sandy loam with subsoils of similar or somewhat heavier texture.	Garner (1951)
Turkish (Oriental)	Grows best on rather shallow soils of medium texture and relatively low fertility.	Garner (1951)
Virginia	Requires light, sandy surface soil; friable, sandy clay subsoil; a comparatively low organic matter content; and a very low reserve of plant nutrients.	Garner (1951)
Tomato	Thrives on many soil types. A fairly fertile, well-drained sandy loam, or heavier soil free from root-knot nematodes and bacterial wilt organisms is best. Soil organic matter must be at least 1.5%.	Deanon (1967)
Vanilla	Requires well-drained, friable soils with good surface layer of humus, or mulch in which the roots can ramify.	Purseglove (1973)
Moderately fine-textured soils (sandy clay loam, silty clay loam, clay loam)		
Abaca	Grows on virtually all types of soil in the Philippines. It is most productive in areas where the soil is volcanic in origin, rich in organic matter, clay loam, loose, friable, and well-drained with a water table of at least 80 cm.	Anunciado, *et al.* (1977) Tabora and Santos (1978)

Table 1. (Continued)

Crops Requiring	Remarks	References
African oil palm	Requires porous and well-drained soil to allow good aeration. Moderately heavy alluvial soils or young volcanic tuff soils are particularly suitable.	Godin and Spensley (1971)
Cacao	Requires soil with good moisture retention, well-drained, and well-aerated. Clay loam soils of good structure are best. Sandy soils allow easy root penetration but have low moisture retention and are recommended only in areas with high and well-distributed rainfall.	Alvim (1977) Batal, *et al.* (1979)
Cowpea Yardlong bean	Grow best on well-drained soils. They could be grown on many types of soils from sandy loam to clay.	Thompson and Kelly (1957)
Cucurbits (General)	Not exacting in soil requirements. Accept almost any soils that are well-drained, aerated, and enriched with organic matter. Heavier soils have greater water holding capacity and can withstand droughty conditions much better than lighter soils.	Kay (1979) Whitaker (1977)
Greater yam	Requires deep, loose, permeable, well-drained, clay soils high in organic matter. Sandy soils are not tolerated because they seldom retain enough moisture and frequently are not fertile. Will tolerate poorer soils than most other edible yam species.	Martin (1976) Kay (1973)
Lanzones	Grows best on fertile loams where problems of drought and flooding are avoided. It is sensitive to poor drainage. It should not be planted where the water table is within 1 m of the soil. Soils high in organic matter are preferred	Almeyda and Martin (1977)
Lesser yam	Grows poorly on sandy soils. Tubers are misshapen when grown on heavy clays. Loam or loose clay soils are preferable but good drainage is a requisite. High organic matter promotes growth.	Martin (1974)
Mango	Soil requirements are not exacting. Well-drained loamy soil at least 2.0-2.5 m deep and containing high	Gangolly, *et al.* (1957) Singh (1967)

Table 1. (Continued)

Crops Requiring	Remarks	References
	amount of organic matter is desirable. Extremely sandy soils, shallow rocky soils, and waterlogged soils are not suitable.	
Mangosteen	Not demanding in soil requirements. It is found growing on almost all types of soils. It prefers a deep soil with high organic matter and good drainage.	Almeyda and Martin (1976) NAS (1975a)
Mungbean	Grows best on well-drained soils.	Thompson and Kelly (1957)
Muskmelon	Grows on several types of soil. But it does not grow on muck or peat, and rarely on heavy clay or adobe. The soil must be well-drained and contain plenty of organic matter.	Davis, *et al.* (1953)
Pea	Requires friable, fertile, and well-drained soil. It performs well on sandy or silt loam soils.	Thompson and Kelly (1957) Knott and Deanon (1967)
Rambutan	Not particular in soil requirements. It grows best on deep soils with high organic matter and drainage. It grows fairly well on heavy soils. On sandy soils, high amount of organic matter is needed.	Almeyda, *et al.* (1979)
Soybean	Can be grown on a wide range of soil types. Sandy loam to clay loam soils with high calcium content are preferred. Tolerates heavy soils well and even waterlogging to some extent.	Kassam (1976) Rachie and Roberts (1974)
Sugarcane	Can be grown on a variety of soil types. It grows best on fertile, deep, well-drained, and thoroughly permeable soil. Clay loam soils are more suitable if there is less rainfall because of their high moisture retention. Sandy loam soils are less suitable except in high rainfall areas.	Jacob and Uexkull (1960) Divinagracia and Jesena (1970)
Watermelon	Good drainage is essential for best results. Soil preference is very similar to those for muskmelon.	Smith (1956)
Wheat	Yields best on medium to heavy textured, well-drained soils with well-balanced fertility. It is not a satisfac-	Reitz (1976)

Table 1. (Continued)

Crops Requiring	Remarks	References
	tory crop on poor, sandy soils, or on poorly drained soils.	
Winged bean	Can adapt to a wide range of soils. Friable, fertile, and well-drained soils are most suitable. It will not survive on waterlogged soils.	NAS (1975b) Quebral, *et al.* (1980)
Fine-textured soils (sandy clay, silty clay, clay)		
Rice		
Lowland	Heavy soils with impervious layer (hardpan) below the plow sole is best suited to lowland rice. The hardpan prevents water from percolating.	Gianzon, *et al.* (1977)
Upland	Soils with light to medium textured surface and a fine textured subsoil are best.	Gianzon, *et al.* (1977)
Taro	Under paddy culture, taro can be grown on all soil types. In upland areas, best results are obtained on deep, well-drained, friable (particularly alluvial) loams. Dasheens (taro types characterized by numerous symmetrical smaller tubers) grow best on loose, water-retentive clay soils.	NAS (1975a)

Table 2. Soil pH tolerance of crops grown in the Philippines

Crops	pH Range	Remarks	References
Abaca	4.8-8.0	Grows on virtually all types of soils.	Duke (1978) Tabora and Santos (1978)
African oil palm	5.5-7.0	Most favorable soil reaction is in the slightly acid range.	Godin and Spensley (1971)
Anthurium	5.0-6.0	Optimum pH range.	McCall (1969)
Angled luffa	4.3-8.7	—	Duke (1978)
Arrowroot	5.0-8.0	Slightly acid soils give best results.	Duke (1978) Kay (1973)
Avocado	4.3-8.3	Optimum pH range is 5.5-6.5.	Duke (1978) Felizardo and

Table 2. (Continued)

Crops	pH Range	Remarks	References
			Mamaril (1966) Jacob and Uexkull (1960)
Banana	4.3-8.3	At low pH, effects of sigatoka disease are more severe and the plants frequently suffer from phosphorous deficiency. On soils of basic reaction, potassium nutrition is often limiting. Good yields have been reported from soils with pH as low as 4.5 and as high as 7.5. Optimum pH range is 6.0-7.5.	Duke (1978) Jacob and Uexkull (1968) Tai (1977) Doorenbos and Kassam (1979)
Black pepper	4.3-7.4	—	Duke (1978)
Breadfruit	5.0-8.0	—	Duke (1978)
Cabbage	4.2-8.3 6.0-6.5 (opt)	Club root of cabbage which also attacks cauliflower is inactivated at pH 7 or above but flourishes in acid soils.	Duke (1978) Doorenbos and Kassam (1979) Atkinson (undated)
Cacao	4.3-8.7	The soil must be slightly acidic to avoid deficiencies of iron and zinc. Very acidic soil may lead to aluminum and manganese toxicity.	Duke (1978) Batal, *et al.* (1979)
Carrot	4.2-8.7	Does not grow well on highly acidic soil. Yields extremely low at pH 5.2. Optimum pH range is 6.0-6.8.	Duke (1978) Thompson and Kelly (1957) Tisbe (1967)
Cashew	4.3-8.7	—	Duke (1978)
Cassava	4.3-8.0	Optimum soil pH range is not well-defined. But on the basis of response to liming, a range of pH 6.0-7.5 is best.	Duke (1978) FAO (1972)
Cauliflower	5.5-6.6	Yield tends to decrease as pH approaches neutrality probably due to decreased availability of boron. Some varieties grow normally at pH below 5.0.	Thompson and Kelly (1957) BPI (1969)
Celery	4.2-6.3	Optimum pH range is 6.0-7.0. Calcium deficiency causes black heart.	Duke (1978) McCall (1969) Knott and Deanon (1967)

Table 2. (Continued)

Crops	pH Range	Remarks	References
Chayote	5.2-8.0	--	Duke (1978)
Chico	4.5-8.7	--	Duke (1978)
Chinese cabbage	4.3-7.0	Seems to tolerate a wide range of soil pH. On Lipa clay loam soil in Los Baños, Laguna, good growth was observed among plants grown at pH 5.9 8.6.	Duke (1978) Bantoc (1967) Arciaga and Galvez (1948)
Chrysanthemum	6.0-6.5	Optimum pH range.	McCall (1969)
Citrus	5.5-6.5	Optimum pH range. If pH goes below 5.5, liming should be done to raise the pH to a desired level. It is grown extensively on highly calcareous soils but not without certain problems.	McCall (1969) Coronel *et al.* (1980) Reuther (1977)
Sweet orange	4.3-8.3	-	Duke (1978)
Pummelo	4.3-8.0	Prefers moderately acidic soils. Too acidic soils should be well-treated with lime before planting.	Duke (1978) Martin and Cooper (1977)
Coconut	4.3-8.3	pH 6.5 is the best since this would assure a balanced amount of nutrients available to the crop. At pH 8, some evidence show that iron is unavailable to the plant. At low pH, growth abnormalities occur which may be associated with aluminum or manganese toxicity. Optimum pH range is 6.0-7.5.	Duke (1978) McCall (1969) Felizardo and Mamaril (1966) Magat (1980) Murray (1977)
Coffee	4.3-8.0	Slightly acid to neutral soils are ideal. Optimum pH is 6.0.	Duke (1978) Hearer (1963) Wellman (1961)
Corn	4.3-8.3	Yields are greatly reduced on soils with pH lower than 5.3; 10% reduction on Adtuyon clay with pH 4.6; 20% reduction on Lipa clay loam with pH 4.7; and 52% reduction on Jasaan clay with pH 4.2. Optimum pH range is 5.3-7.3.	Duke (1978) Mercado, *et al.* (1976)

Table 2. (Continued)

Crops	pH Range	Remarks	References
Cotton	4.3-8.4	Saline and alkaline soils are poorly suited. In some irrigated areas, cotton does best at pH 6.5-7.0. Optimum pH range is 5.0-7.0.	Duke (1978) Brown and Ware (1958) Bondad, *et al.* (1975) FAO (1972)
Cowpea	4.3-8.3	Development of nitrogen-fixing bacteria and nodule formation are best if the soil reaction is close to neutral. Optimum pH range is 5.5-7.0.	Duke (1978) Atkinson (undated) Deanon and Soriano (1967)
Cucumber	4.3-8.7	Grows best on slightly acid to neutral soils. Optimum pH range is 5.5-6.5.	Duke (1978) McCall (1969) Tisbe, *et al.* (1967)
Durian	4.3-8.0	—	Duke (1978)
Eggplant	4.3-8.7	A soil pH lower or higher than the optimum range results in low yields. Optimum pH range is 5.5-6.8.	Duke (1978) Martin and Pollack (1979) Deanon (1967)
Garlic	4.5-8.3	Recommended pH range is 5.5-6.5.	Duke (1978) Bautista, *et al.* (1972)
Ginger	4.3-7.5	Recommended pH range is 6.0-6.8.	Duke (1978) Cadiz, *et al.* (1979)
Grapes			
Wine grape	4.3-8.7	If the soil pH is below 5, liming will usually improve growth. Optimum pH range is 6.5-7.0.	Pantastico, *et al.* (1976) Duke (1978)
Fox grape	4.9-7.5		
Muscodine grape	5.8-8.0		
Greater yam	4.8-8.0	—	Duke (1978)
Guava	4.3-8.7	—	Duke (1978)
Horseradish tree	4.5-8.7	—	Duke (1978)
Jackfruit	4.3-8.0	—	Duke (1978)
Jute			
Tussa jute	4.5-8.2	Most favorable soil reaction ranges from pH 5.5-6.5.	Felizardo and Mamaril (1966) Duke (1978)
White jute	5.1-7.5		

Table 2. (Continued)

Crops	pH Range	Remarks	References
Kenaf	4.3-8.2	Prefers neutral soils.	Duke (1978) Kassam (1976)
Lablab bean	4.4-7.8	Grows well on soils ranging from acid to alkaline.	NAS (1979)
Lanzones	4.3-8.0	Will not tolerate extremely alkaline soils. Slightly acid to neutral soils are preferred.	Duke (1978) Almeyda and Martin (1977)
Lettuce	4.2-8.7	Will not thrive on very acid soils. Optimum pH range is 6.0-7.0.	Atkinson (undated) Bantoc (1967)
Lima bean	4.3-8.4	More sensitive to soil acidity than snap beans. Optimum pH range is 6.0-7.0.	Duke (1978) NAS (1979) Thompson and Kelly (1957)
Mango	4.3-8.0	Alkaline or calcareous soils are not suitable. Optimum pH range is 5.5-7.5.	Duke (1978) Gangolly, *et al.* (1957) Singh (1967) McCall (1969)
Mangosteen	4.3-8.0	Slightly acid soils are needed to grow the best trees and produce the heaviest yields. It does not do well on alkaline soils.	Duke (1978) NAS (1975) Almeyda and Martin (1976)
Mungbean	4.3-8.3	Soils that are too acidic adversely affect the growth of rhizobium bacteria and the availability of some nutrients. Optimum pH range is 5.8-6.5.	Duke (1978) Tu (1978) Quebral, *et al.* (1977)
Muskmelon	4.3-8.7	Planting on unlimed highly acid soils results in poor growth and the leaves turn yellowish (acid-yellows). The soil should be free of toxic amounts of alkali. Optimum pH range is 6.0-6.8.	Tisbe, *et al.* (1967) Smith (1956) Davis, *et al.* (1953)
Onions	4.3-8.2	Very acid and very alkaline soils cause slow growth and late maturity. Optimum pH range is 5.8-6.5.	Duke (1978) Thompson and Kelly (1957) Deanon and Cadiz (1967)
Okra	4.3-8.7	Only slightly tolerant to acidic soils, but its wide distribution in the tropics and its	Duke (1978) Atkinson (undated)

Table 2. (Continued)

Crops	pH Range	Remarks	References
		vigorous growth wherever sufficient fertility exists contradicts this general observation. Optimum pH range is 6.0-6.5.	Martin and Ruberte (1978)
Papaya	4.3-8.0	Optimum pH range is 6.0-6.5.	Duke (1978) Pantastico, *et al.* (1977)
Pea	4.2-8.6	Does not thrive on highly acid soil. Optimum pH range is 6.0-7.5.	Duke (1978) Jacob and Uexkull (1960) Thompson and Kelly (1957)
Peanut	4.3-8.3	Very acidic soils reduce the potential efficiency of nitrogen-fixing bacteria that partly supply the nitrogen needs of the plant. Optimum pH range is 5.8-6.2.	Duke (1976) Cagampang and Lantican (1975)
Pigeon pea	4.3-8.4	--	Duke (1978)
Pineapple	3.5-7.8	Calcareous soils are unsuitable owing to the development of chlorosis due to iron deficiency. Optimum pH range is 4.5-5.5.	Duke (1978) Bartholomew and Kadzimin (1977) Collins (1960)
Potato	4.2-8.3	Above pH 6.0, potatoes are liable to suffer from scab unless resistant varieties are grown. When the pH is lowered to 5.3, the virulence of the scab-causing organisms is much reduced. Optimum pH range is 5.5-6.0.	Duke (1978) Kay (1973) Balaoing, *et al.* (1979) Brady (1974)
Radish	4.2-8.3	A slightly acid soil is ideal. Optimum pH range is 5.5-6.5.	Duke (1978) Atkinson (undated) Tisbe (1967)
Rambutan	4.3-8.0	Susceptible to iron deficiency. Optimum pH range is 5.0-6.5.	Duke (1978) Almeyda, *et al.* (1979)
Ramie	4.3-7.5	--	Duke (1978)
Rose	5.0-6.0	Optimum pH range.	Atkinson (undated)
Rice	4.3-8.3	Optimum pH range for paddy rice is about 7.0; upland rice performs satisfactorily at pH	Duke (1978) Kassam (1976)

Table 2. (Continued)

Crops	pH Range	Remarks	References
		5.0-6.0; on alkaline black soils, paddy rice performs satisfactorily at pH 8.0-9.0.	
Rubber	4.3-8.0	*Hevea* rubber can tolerate very acid (as low as pH 3.5) and infertile soils because of its extensive root system and high nutrient absorbing capacity.	Duke (1978) Jacob and Uexkull (1960) Felizardo and Mamaril (1966)
Sesame	4.3-8.7	Grows on well-drained soils with pH 6.0-6.5 in West Africa.	Duke (1978) Kassam (1976)
Snap bean	4.2-8.7	Sensitive to high concentration of aluminum and manganese. It does not produce large yields under extremely acid soils. It is sensitive to zinc deficiency. Optimum pH range is 5.5-6.5.	Duke (1978) McCall (1969) Thompson and Kelly (1957) Atkinson (undated) Jannsen (1978)
Sorghum	4.3-8.7	Optimum pH range is 5.5-7.0.	Duke (1978) Atkinson (undated)
Soursop	4.3-8.0	—	Duke (1978)
Soybean	4.3-8.4	Liming to pH 6.0-6.5 enhances nitrification and nitrogen fixation. Avoid saline soils. Optimum pH range is 5.5-7.0.	Duke (1978) Tu (1978) McCall (1969) Atkinson (undated) Quebral, *et al.* (1976)
Squash/ Pumpkin		Grows best on slightly acid to neutral soils. Optimum pH range is 5.5-7.0.	Felizardo and Mamaril (1966) Tisbe, *et al.* (1967)
boston marrow	4.3-8.3	—	Duke (1978)
Crook-neck pumpkin	4.3-8.4	—	
Vegetable marrow	4.3-8.4	—	

Table 2. (Continued)

Crops	pH Range	Remarks	References
Star apple	4.3-8.7	—	Duke (1978)
Sugarcane	4.3-8.4	Optimum pH range is 5.8-7.2.	Duke (1978) McCall (1969)
Sunflower	4.5-8.7	Most favorable pH range is 6.0-7.5.	Duke (1978) Jacob and Uexkull (1960)
Swamp morning glory	4.3-8.3	—	Duke (1978)
Sweet pepper/ Tabasco pepper	4.3-8.7	Can be grown on any soil at a wide range of pH values. Optimum pH range is 5.5-6.5.	Duke (1978) Atkinson (undated) McCall (1969) Martin, *et al.* (1979)
Sweet potato	4.3-8.7	Sensitive to alkaline and saline conditions. Infections with certain disease organisms are more prevalent when soil approaches neutrality. Optimum pH range is 5.6-6.6.	Tu (1978) Kay (1973) Minges and Morris (1953) Kassam (1976)
Sweetsop	4.3-8.0	—	Duke (1978)
Tannia	5.1-8.1	Preferred pH range is 5.5-6.5. Sensitive to saline conditions.	Duke (1978) Kay (1973) Kassam (1976)
Taro	4.3-7.5	Optimum pH range is 5.5-6.5.	Duke (1978) McCall (1969) Kay (1973)
Tobacco	4.3-8.7	High soil pH and moisture encourage black root rot. Optimum pH range is 5.0-5.6.	Duke (1978) Quimio, *et al.* (1979)
Tomato	4.3-8.7	Optimum pH range is 5.5-6.5.	Duke (1978) McCall (1969)
Water chestnut	5.3-6.5	—	Duke (1978)
Watermelon	5.3-8.7	Unlike muskmelon, it grows best on a wide range of soil acidity. Lime need not be applied to soils with pH 5.0 or higher. Optimum pH range is 5.0-5.5.	Duke (1978) McCall (1969) Atkinson (undated) Doolittle, *et al.* (1962) Smith (1956)
Wax gourd	5.5-7.5	—	Duke (1978)

Table 2. (Continued)

Crops	pH Range	Remarks	References
Wheat	4.5-8.6	Optimum pH range is 5.5-7.0.	Duke (1978) Atkinson (undated)
White-flowered gourd	4.3-8.7	—	Duke (1978)
Winged bean	5.5-7.0	Sensitive to either alkaline or very acidic soil reaction.	Quebral, *et al.* (1980)
Yam bean	4.8-7.3	—	Duke (1978)
Yardlong bean	4.3-7.3	Development of nitrogen fixing bacteria and nodule formation are best if soil reaction is close to neutral. Optimum pH range is 5.5-6.8.	Ballon, *et al.* (1972) Deanon and Soriano (1967)

Table 3. Nutrient removal of crops grown in the Philippines

Crops	Yield (mt/ha)	Nutrient Removal (kg/ha)			References
		N	P_2O_5	K_2O	
African oil palm	2.0 (palm oil)	130	55	210	Jacob and Uexkull (1960)
	15 (bunches)	90	20	135	Godin and Spensley (1971)
Asparagus	4.0 (all)	100	28	90	Jacob and Uexkull (1960)
Banana	5.0 (fruit)	63	16	207	Jacob and Uexkull (1960)
Cabbage	50 (all)	200	100	200	Jacob and Uexkull (1960)
	70 (head)	250	90	320	Villegas and Malixi (1977)
Cacao	1.0 (pods)	13.4	6.7	11.2	Jacob and Uexkull (1960)
Carrot	40 (roots) + 10 (tops)	106	52	220	Jacob and Uexkull (1960)
	30	125	55	200	Villegas and Malixi (1977)
Cashew	155 kg apples + 24 kg nuts + vegetative parts	2.85[a]	0.75[a]	1.26[a]	Ohler (1979)

Table 3. (Continued)

Crops	Yield (mt/ha)	Nutrient Removal (kg/ha)			References
		N	P_2O_5	K_2O	
Cassava	35 (tuberous roots)	60	50	260	Jacob and Uexkull (1960)
Castor oil plant	1.5 (seeds)	45	18	15	Jacob and Uexkull (1960)
Cauliflower	50 (all)	200	80	250	Jacob and Uexkull (1960) Villegas and Malixi (1977)
Celery	20 (all)	130	50	200	Jacob and Uexkull (1960)
	30	180	80	300	Villegas and Malixi (1977)
Coconut	124 plants/ha	74	30	137	Godin and Spensley (1971)
	16-30 yr old	59-91	27-40	85-131	Murray (1977)
Coffee	1.0 (berries)	30.3	5.6	44.8	Jacob and Uexkull (1960)
Corn	4.4 (grain) 7.5 (stover)	128	48	140	Jacob and Uexkull (1960)
	5.4 (grain)	138	65	114	Kassam (1976)
Cotton	392 kg (lint) 897 kg (seed)	84	34	87	Jacob and Uexkull (1960)
Cowpea[b]	1.0 (seeds?)	85	15	30	Kassam (1976)
	2.4 (pods)	150	40	110	Villegas and Malixi (1977)
Cucumber	30 (fruit)	50	40	80	Jacob and Uexkull (1960) Villegas and Malixi (1977)
Ginger	50 (rhizomes)	247	71	248	Anonymous (1975)
Grapes	10 (fruit)	80	30	100	Jacob and Uexkull (1960)
Lettuce	25 (all)	53	20	120	Jacob and Uexkull (1960)
Mango	1.0 (fruit)	0.32[a]	0.15[a]	3.08[a]	Lapade (1977)
Mungbean[b]	2.0 (seed)	87	26	28	Quebral, *et al.* (1977)

Table 3. (Continued)

Crops	Yield (mt/ha)	Nutrient Removal (kg/ha)			References
		N	P_2O_5	K_2O	
Onion	30 (all)	80	40	120	Jacob and Uexkull (1960)
Peas[b]	2.0 (seeds?) + 3.5 (straw)	126	30	65	Jacob and Uexkull (1960)
Peanut[b]	1.8 (seeds?)	90	25	60	Jacob and Uexkull (1960)
	1.0 (pods)	51-63	9-11	20-25	Kassam (1976)
	2.5 (pods) + 5.0 (tops)	157	27	115	Godin and Spensley (1971)
Pineapple	40 (fruit)	110	30	275	Jacob and Uexkull (1960)
Potato	10-18 (tubers)	50-80	20-30	80-140	Kassam (1976)
	25 (tubers)	115-120	45	200	Kassam (1976)
	30 (tubers)	130	60	180	Villegas and Mallxi (1977)
Radish	20 (all)	110	60	100	Jacob and Uexkull (1960)
Rubber	879 kg (latex)	47.1	5.6	21.3	Jacob and Uexkull (1960)
Rice	7.9 (grain)	86.1	36.2	29.4	De Datta (1981)
	7.0 (straw)	37.4	12.8	115.1	
Sorghum	4.1 (grain)	132	28	69	Kassam (1976)
Soybean[b]	2.0 (seed)	126	29	38	Jacob and Uexkull (1960)
	1.8 (seed)	160	60	115	Villegas and Mallxi (1977)
	1.0 (seed)	60	75	80	Kassam (1976) Godin and Spensley (1971)
Sesame	0.5	25	7	30	Kassam (1976)
	2.2	120	70	160	Kassam (1976)
Sugarcane	28 (cane)	30	20	60	Kassam (1976)
	74 (cane)	107	60	300	Kassam (1976)
	100 (cane) + 60 (tops and trash)	150	105	300	Halliday (1956)
	100 (cane)	140-180	80-120	300-380	Davide (1973)
Sunflower	Good crop	93-113	17-20	222-277	Godin and Spensley (1971)
	Modest crop	27-34	5-6	67-85	
Sweet potato	15 (tuberous roots)	70	20	110	Kassam (1976)

Table 3. (Continued)

Crops	Yield (mt/ha)	Nutrient Removal (kg/ha)			References
		N	P_2O_5	K_2O	
Tobacco	1.9 (leaf)	101	25	145	Kassam (1976)
	2.0 (leaf)	130	40	240	Jacob and Uexkull (1960)
Tomato	40 (fruit)	110	30	160	Jacob and Uexkull (1960)

[a]kg/tree
[b]Can obtain its nitrogen requirement largely from the atmosphere

Table 4. Fertilizer recommendations for crops grown in the Philippines

Crops	Fertilizer Recommendations (kg/ha)			Remarks	References
	N	P_2O_5	K_2O		
Abaca	100-200	—	150-200	Apply the recommended amount of fertilizer annually in 2-4 split applications. Nitrogen greatly improves growth and suckering ability. Potassium increases the tensile strength of the fibers. Little or no response of abaca to phosphorous is observed in Philippine soils.	Anunciado, *et al.* (1977)
Avocado[a]					
Nonbearing trees	20-40	—	—	Apply the recommended fertilizer in two equal installments. During the first year, apply it 1 month after planting and then before the end of the rainy season. In subsequent years, apply it at the onset of the rainy season and the before the end of the rainy season. As the trees grow bigger and as fruit production increases, the amount of fertilizer has to be increased correspondingly.	Coronel (1976)
Start of fruit production	70	70	70		
Full grown trees (15-20 years old)	280	280	280		
Banana	160	60	120	Apply the recommended amount of fertilizer in 2-4 split applications per year. Accumulation of salt in the soil above a concentration of 500 ppm is toxic to banana.	Felizardo, *et al.* (1979) Tai (1977)

Cabbage	90-240	30-60	30-60	Apply all phosphorous and potassium and half of nitrogen along the rows at planting time. Side dress the remaining nitrogen 3-4 weeks after transplanting. Since cabbage is a leafy vegetable, nitrogen is the most effective in producing high yields.	Villareal, *et al.* (1972) Deanon, *et al.* (1975)
Cacao[a]					
1st year	14-21	14-21	14-21	Apply the recommended quantity in two or more equal parts: the first part at the start of the rainy season and the other at equal intervals later in the season. From the fifth year onwards, the amount of fertilizer may be increased or decreased depending on the need of the plants.	Batal, *et al.* (1979)
2nd year	32	32	32		
3rd year	42	42	42		
4th year	63	63	63		
Cashew[a]					
Nonbearing trees	20-40	—	—	Apply half of the recommended fertilizer at the start of the rainy season and the other half towards the end of the rainy season. Cashew is modest in its soil fertility requirements. It yields on soils too poor or too dry for other crops.	Coronel (1977) Ohler (1969)
Start of the fruiting	55-85	55-85	55-85		
Full grown trees	140	140	140		
Cassava	50-100	50-100	75-120	Can grow better than other crops on relatively poor soils. It yields better than many others when grown on more fertile soils. Like all starch-producing plants, cassava requires large quantities of potassium in addition to nitrogen and phosphorous.	Villanueva, *et al.* (1977) Jacob and Uexkull (1960)

Table 4. (Continued)

Crops	Fertilizer Recommendations (kg/ha)			Remarks	References
	N	P_2O_5	K_2O		
Cauliflower	90-240	30-60	30-60	Apply all phosphorous and potassium and half of nitrogen along the rows at planting time. Side dress the remaining nitrogen 3-4 weeks after transplanting.	Villareal, *et al.* (1972) Deanon, *et al.* (1975)
Chico[a]					
Young nonbearing trees	50-100	—	—	Apply the recommended fertilizer in two equal installments. During the first year, apply it 1 month after planting and then before the end of the rainy season. In subsequent years, apply it at the onset of the rainy season and then before the end of the rainy season. As the trees grow bigger and as fruit production increases, the amount of fertilizer has to be increased correspondingly.	Coronel (1976)
Start of fruit production	70	70	70		
Full grown trees (15-20 years old)	280	280	280		
Chinese cabbage	90-240	30-60	30-60	Apply all phosphorous and potassium and half of nitrogen along the rows at planting time. Side dress the remaining nitrogen 3-4 weeks after transplanting. Since Chinese cabbage is a leafy vegetable, nitrogen is the most effective in producing high yields.	Villareal, *et al.* (1972)
Citrus[a]					
4 years old	150	100	100	Apply 50-100 g urea/plant 1 month after transplanting and	Coronel, *et al.* (1980)
5 years old	225	140	200		

6 years old	300	200	300	200-300 g urea/plant in the 2nd year. The recommended fertilizer levels should be applied in two to three installments: at the start of the rainy season, middle of the rainy season, and towards the end of the rainy season.	
7 years old	400	200	360		
8 years old	500	200	420		
Coconut[a]					
1-2 years old	85	40	180	Apply half of the recommended amount every 6 months preferably at the onset of the rainy season and then before the start of the dry season. Starting the 5th year, apply A and B alternately every 2 years. Coconut has a high demand for potassium.	Laudencia, *et al.* (1975)
3-4 years old	170	—	360		
5 years old and up	(A) 335	40	840		Murray (1977)
	(B) 335	—	840		
Coffee					
Seedlings	1.5 g/ seedling	0	0	Make a furrow about 5 cm deep around the plant using the periphery of the crown as guide. Apply the fertilizer by band application and cover with soil. Apply the recommended amount at the start or before the end of the rainy season.	Felizardo, *et al.* (1983)
Nonbearing	450 g/ tree/ year	450 g/ tree/ year	450 g/ tree/ year		
Bearing	400 g/ tree/ year	50 g/ tree/ year	200 g/ tree/ year	Apply the fertilizer on holes or treaders made around the trees at the area between the periphery of the crown and half of the distance to the base. Apply half of nitrogen and all phosphorous and potassium by band application at the start of	

Table 4. (Continued)

Crops	Fertilizer Recommendations (kg/ha)			Remarks	References
	N	P_2O_5	K_2O		
				the rainy season and cover with soil. Side dress the remaining half of nitrogen before the end of the rainy season.	
Common bean	30-50	70-120	30-50	Excess nitrogen will tend to keep the plants in vegetative state, delay maturity, reduce pod set, and may even lower yield.	Deanon, *et al.* (1975) Meiners and Kraft (1977) Jannsen (1977)
Corn	90	30	30	During the dry season, apply all the recommended amount of fertilizer at planting time. During the wet season, apply half of nitrogen and all of phosphorous and potassium at planting. Apply the other half of nitrogen before hilling up (4-5 weeks after emergence, or when the plants are about knee-high).	Felizardo, *et al.* (1983)
Cotton	80-120	—	50-90	For cotton following legumes, nitrogen should not exceed 50 kg/ha.	Bondad, *et al.* (1975)
Cowpea	30-50	70-120	30-50	Avoid heavy application of nitrogen. The rhizobia in their root nodules make nitrogenous compounds available to the plants and enrich the soil in which they are grown.	Deanon, *et al.* (1975) Meiners and Kraft (1977) NAS (1979)

Cucumber	45-120	45-120	45-120	—	Villareal, *et al.* (1972)
Durian					
1st year	40	10-20	—	Apply the recommended fertilizer in two equal installments. During the first year, apply it 1 month after planting and then before the end of the rainy season. In subsequent years, apply it at the onset of the rainy season and then before the end of the rainy season. As the trees grow bigger and as fruit production increases, the amount of fertilizer has to be increased correspondingly.	Coronel (1974)
Start of fruit production	140	140	140		
Peak of fruit production	280	280	280		
Eggplant	90-100	180-200	90-100	Can be harvested over a long period. Several applications of mineral fertilizer may be required.	Villareal, *et al.* (1972) Martin and Poliack (1979)
Garlic	40-200	110-240	110-240	Apply all phosphorous and potassium and half of the nitrogen at planting time. Side dress the remaining nitrogen as bulbing begins.	Bautista, *et al.* (1972)
Ginger	145	145	145	An exhausting crop and benefits greatly from fertilization.	Gloria, *et al.* (undated) Purseglove (1973)
Grapes[b]					
Nonbearing					
Preplanting	320	400	300	Mix thoroughly with 1 m^3 soil mixture before filling in the hole.	Pantastico, *et al.* (1977) Felizardo, *et al.* (1983)

Table 4. (Continued)

Crops	Fertilizer Recommendations (kg/ha)			Remarks	References
	N	P_2O_5	K_2O		
				This can be omitted if compost or any organic fertilizer materials have been incorporated in the soil.	
At planting	22	0	0	Dissolve in 2-3 L of water. Use solution to water the plants after planting.	
2 weeks after planting up to 3rd month	7	1.5	1.5	Dissolve in 1-2 L of water and drench the soil around the plant 2 weeks after planting. Thereafter, apply every 15 days around the base of the plant and incorporate with the soil.	
Nonbearing					
4th to 6th month	14	3	3	Apply once a month around the plant 15 cm from the base. Incorporate with the soil.	
7th to 9th month	28	6	6	Apply once a month around the plant 15 cm from the base. Incorporate with the soil.	
10th to 11th month	56	11	11	Apply once a month around the plant 15 cm from the base. Incorporate with the soil.	
12th month	74-89	18-21	18-21	Apply once a month around the plant 15 cm from the base. Incorporate with the soil.	

Bearing					
Pruning time	30-38	34-43	14-18	Apply around the plant 30-60 cm from the base. Incorporate with the soil.	
When the berries set	59-74	14-18	14-18	Apply around the plant 30-60 cm from the base. Incorporate with the soil.	
Start of change in berry color	0	0	120-150	Apply around the plant 30-60 cm from the base. Incorporate with the soil.	
After harvesting	35-42	35-42	35-42	Apply around the plant 30-60 cm from the base. Incorporate with the soil.	
Rest period of 1-2 months	—	—	—	Mix manure or compost with the soil at 10 L/plant.	
1-2 weeks before 2nd pruning	30-38	34-43	14-18	Apply around the plant 30-60 cm from the base. Incorporate with the soil.	
When berries have set	59-74	14-18	14-18	Apply around the plant 30-60 cm from the base. Incorporate with the soil.	
Start of change in berry color	0	0	120-150	Apply around the plant 30-60 cm from the base. Incorporate with the soil.	
After harvesting	35-42	35-42	35-42	Apply around the plant 30-60 cm from base. Incorporate with the soil.	
Rest period of 1-2 months	—	—	—	Mix manure or compost with the soil at 10 L/plant.	
Greater yam	—	—	—	Tolerates poorer soils than most other edible yam species. It responds well to fertilization.	Kay (1973)

Table 4. (Continued)

Crops	Fertilizer Recommendations (kg/ha)			Remarks	References
	N	P_2O_5	K_2O		
Lanzones[a]					
1st year	40	—	—	Apply the recommended fertilizer in two equal installments. During the first year, apply it 1 month after planting and then before the end of the rainy season. In subsequent years, apply it at the onset of the rainy season and then before the end of the rainy season. As the trees grow bigger and as fruit production increases, the amount of fertilizer has to be increased correspondingly.	Coronel (1977)
Start of fruit production	140	140	140		
Peak of fruit production	280	280	280		
Lima bean	30-50	70-120	30-50	In poor soils of the lowland humid tropics, lima bean is better adapted and gives more reliable yields than common bean.	Deanon, *et al.* (1975) NAS (1979)
Mango[a]					
Young trees (1 year old)	30-40	30-40	30-40	Apply the required amount in two equal doses: at the start of the rainy season and then before the end of the rainy season.	Coronel, *et al.* (1978)
Nonbearing (2-5 years old)	135-210	40-70	40-70		
Bearing trees	210-350	210-350	210-350		
Mangosteen					
1st year	20	—	—	Apply the recommended fertilizer in two equal installments: at the start of the rainy season and then at the end of the rainy season. Gradually increase the amount of fertilizer every year as	Coronel(1977)
Start of fruit production	70	70	70		

				the trees grow bigger and fruit production increases.	
Mungbean	20	30-45	30-45	The rhizobia in their root nodules make nitrogenous compounds available to the plants and enrich the soil in which they are grown.	Quebral, *et al.* (1977) NAS (1979)
Muskmelon	45-120	45-120	45-120		Deanon, *et al.* (1975) Villareal, *et al.* (1972)
Onion	55-120	105-240	55-120	Apply all phosphorous and potassium and half of nitrogen at planting time. Side dress the remaining nitrogen as bulbing begins.	Deanon, *et al.* (1975) Bautista, *et al.* (1972)
Orchids					
Arachnis-Renanthera types	—	—	—	Dried animal manure can be used as fertilizer. A tablespoon of manure may be applied directly at the base of each plant once every 2 months.	Deanon, *et al.* (1975) Bautista, *et al.* (1977)
Cattleyas	For young seedlings and mature plants potted in bark — 1 tsp of 30-10-10 plus trace elements dissolved in 4 L of water For plants potted in osmunda fiber — 1 tsp of 12-12-12 dissolved in 4 L of water			Excessive nitrogen encourages the plants to produce more pseudobulbs and leaves with few flowers.	Valmayor, *et al.* (1977)
Dendrobium	12-8-8 fertilizer (containing trace elements) diluted at the rate of 15 ml/4 L of water			Apply the fertilizer solution to the plants and potting media liberally once a week.	Valmayor, *et al.* (1977)

Table 4. (Continued)

Crops	Fertilizer Recommendations (kg/ha)			Remarks	References
	N	P_2O_5	K_2O		
Phalaenopsis	For seedlings — complete fertilizer (12-12-12 or 14-14-14) dissolved at the rate of 1 level tsp/4 L water and ammonium sulfate dissolved at the rate of 1 level tbsp/4 L water			Apply the complete fertilizer every 2 weeks and the ammonium sulfate every 2 months (replacing an application of the complete fertilizer).	Valmayor, *et al.* (1977)
Vandas	—	—	—	Fertilize the plants weekly with liquid fertilizers containing trace elements during hot, dry months. At other times, fertilize the plants twice a month.	Valmayor, *et al.* (1977)
Papaya[b]					
1st year	95	—	—	Fertilize the plants with 50 g ammonium sulfate at planting time, or 3 months later until the plants are 1 year old. Thereafter, apply 200 g ammonium sulfate every 3 months. Provide young plants with readily available phosphorous. Potassium is important after the flowering stage.	Pantastico, *et al.* (1977)
Subsequent years	170	—	—		
Pea	30-50	70-120	30-50	A soil with excessive organic residue or nitrogen is not ideal since it promotes vine growth at the expense of pod production.	Deanon, *et al.* Meiners and Kraft (1977)
Peanut	30	30	30	Its nitrogen needs are almost totally provided by the rhizobial	Quebral, *et al.* (1978)

				system. Phosphorous is probably the most important mineral nutrient required. Calcium is important in the formation and development of seed and in nodulation.	Rachie and Roberts (1974)
Pechay	90-240	30-60	30-60	Since pechay is a leafy vegetable, nitrogen is the most effective in producing high yields than phoshorous and potassium.	Villareal, *et al.* (1972)
Pepper	90-100	180-200	90-100	Peppers may need at planting time a little more nitrogen and potassium than tomatoes. Unless there is adequate fertility present in the early stages of growth, peppers start to bloom too soon.	Villareal, *et al.* (1972) Deanon, *et al.* (1967)
Pili[a]					
1st year	15-30	15-30	15-30	The amount of fertilizer recommended for the year should be gradually increased every year until the first flowering and fruiting season. The time and method of fertilizer application are the same as for other fruit trees.	Coronel (1976)
Start of fruit production	70	70	70		
Full bearing trees	280	280	280		
Pineapple					
1 month old	60	—	150	Plants adequately fertilized with nitrogen grow vigorously and produce large fruits. Potassium increases size and sweetness of fruit. Philippine soils grown to pineapple are gradually sufficient in phosphorous. If flower enducing chemicals are used, do not apply	Bondad, *et al.* (1976)
4 months old	50	—	—		
7 months old	60	—	150		
10 months old	50	—	—		

Table 4. (Continued)

Crops	Fertilizer Recommendations (kg/ha)			Remarks	References
	N	P_2O_5	K_2O		
				nitrogenous fertilizer within 2-3 months before enducer application.	
Potato	90-150	100-150	150-200	To improve soil physical properties, 2-3 mt of well-developed farmyard manure or compost may be applied per hectare every two cropping seasons. Large doses of potassium chloride are considered to lower quality.	Balaoing, *et al.* (1979) Brady (1974)
Rambutan[a]					
1st year	40-45	20	—	Apply the recommended fertilizer in two equal installments. During the first year, apply it 1 month after planting and then before the end of the rainy season. In subsequent years, apply it at the onset of the rainy season and then before the end of the rainy season. As the trees grow bigger and as fruit production increases, the amount of fertilizer has to be increased correspondingly. Rambutan is susceptible to iron deficiency.	Coronel (1976) Almeyda, *et al.* (1979)
Start of fruit production	70	70	70		
Peak of fruit production	280	280	280		
Rice					
Irrigated, transplanted, wet	60	30	0	Apply half of nitrogen and all phosphorous immediately before	Felizardo, *et al.* (1983)

season, clayey soils				the last harrowing and the remaining nitrogen, 40-45 days after transplanting.	
Irrigated, transplanted, wet season, loamy soils	60	30	30	Apply half of nitrogen and all phosphorous immediately before the last harrowing and the remaining nitrogen, 40-45 days after transplanting.	Felizardo, *et al.* (1983)
Irrigated, transplanted, dry season, all soils	90	30	30	Apply half of nitrogen and all phosphorous immediately before the last harrowing and the remaining nitrogen, 40-45 days after transplanting.	Felizardo, *et al.* (1983)
Rubber[b]					
0-12 months old	8-9	8-9	8-9	Apply the recommended amount of fertilizer every 3 months starting at 3 months after transplanting.	Barraca, *et al.* (1975)
12-24 months old	15-18	15-18	15-18	Apply the recommended amount of fertilizer when the plants are 18 and 24 months old.	
24-66 months old	60-70	60-70	60-70	Apply the recommended amount of fertilizer every 6 months from the time the plants are 30 months old.	
Sorghum					
Sandy to sandy loam				For the dry season crop, apply all nitrogen, phosphorous, and potassium before planting. For the rainy season crop, apply 2/3 nitrogen, and all phosphorous and potassium before planting. Side dress the rest of the nitrogen just before hilling up.	Mercado, *et al.* (1975)
Gray to black	50	30	30		
Brown to reddish-brown	55	40	30		

Table 4. (Continued)

Crops	Fertilizer Recommendations (kg/ha)			Remarks	References
	N	P_2O_5	K_2O		
Loam to clay loam					
Gray to black	40	20	20		
Brown to reddish-brown	55	40	0		
Clay					
Gray to black	55	0	0		
Brown to reddish-brown	55	40	0		
Soybean					
Dry season	24	30	—	Inoculate seeds with appropriate rhizobium bacteria. Soybean likes a fertile soil with a high calcium content. Although soybean can fix atmospheric nitrogen, it is often advisable to apply a light dressing of nitrogen at the time of sowing to obtain rapid initial development of the crop.	Quebral, *et al.* (1976) Jacob and Uexkull (1960) Godin and Spensley (1971)
Wet season	—	±30	—		
Sugarcane	170	120	240	The crop is a heavy feeder and exhausting to the soil.	Felizardo, *et al.* (1979) Kassam (1976)
Sweet potato	60-90	90-120	60-120	Apply half of the recommended amount of fertilizer at planting and the other half a month later. Sweet potato has high requirements for other nutrients particularly calcium, boron, and magnesium.	Cadiz and Gabucan (1972) Kassam (1976)

Tannia	60-90	60-90	60-90	Fertilizers should be applied immediately before planting, 1-2 months after planting, and 3-4 months after planting.	Villanueva, *et al.* (1977)
Taro	60-90	60-90	60-90	Fertilizers should be applied immediately before planting, 1-2 months after planting, and at 3-4 months after planting. Taro has high calcium requirement.	Villanueva, *et al.* (1977) Kassan (1976)
Tobacco					
Burley	30	30-60	30-60	Large doses of potassium chloride lower leaf quantity.	Quimio, *et al.* (1979) Brady (1974)
Turkish	10-15	20-30	30-45		
Virginia	20	30	40-60		
Cigar-filler	40-45	35-70	35-50		
Cigar-wrapper	35	35-70	35-70		
Tomato	60-95	120-190	60-95	Apply all phosphorous and half of nitrogen and potassium at planting time. Side dress the remaining nitrogen and potassium 1 month after transplanting.	Villareal, *et al.* (1972) Deanon, *et al.* (1975)
Watermelon	45-120	45-120	45-120	Does not require heavy application of fertilizer. Excessive nitrogen will cause abundant vines, delay maturity, and lead to hollow heart.	Deanon, *et al.* (1975) Villareal, *et al.* (1972) Holht (1980)

Table 4. (Continued)

Crops	Fertilizer Recommendations (kg/ha)			Remarks	References
	N	P_2O_5	K_2O		
Winged bean	60	30	0	Can be cultivated even in poor soils owing to its nitrogen-fixing ability.	Quebral, *et al.* (1980)
Yardlong bean	30-50	70-120	30-50	The rhizobia in their root nodules make nitrogenous compounds available to the plants and enrich the soil in which they are grown.	Deenon, *et al.* (1975) NAS (1979)

[a]Fertilizer recommendations are in grams per tree per year
[b]Fertilizer recommendations are in grams per plant

Table 5. Relative tolerance of crops to soil salinity[a] (FAO/UNESCO, 1973; US Salinity Laboratory, 1954)

Highly tolerant ($EC_e \times 10^3$ = 16-10)	Moderately tolerant ($EC_e \times 10^3$ = 10-4)	Sensitive ($EC_e \times 10^3$ = 4-2)
	Fruit Crops	Fruit Crops
Cotton	Pomegranate	Orange
Asparagus	Grapes	Strawberry
		Lemon
		Avocado
	Field Crops	Other Crops
	Wheat	Radish
	Rice	Celery
	Sorghum (grain)	Common bean
	Corn (field)	Sugarcane
	Sunflower	
	Castor bean	
	Vegetable Crops	
	Tomato	
	Cabbage	
	Pepper (sweet)	
	Cauliflower	
	Lettuce	
	Corn (sweet)	
	Potato	
	Carrot	
	Onion	
	Pea	
	Cantaloupe	
	Squash	
	Cucumber	

[a]Within each crop group, the species are listed as much as possible in the order of decreasing salt tolerance but a difference of two or three places in a column may not be significant

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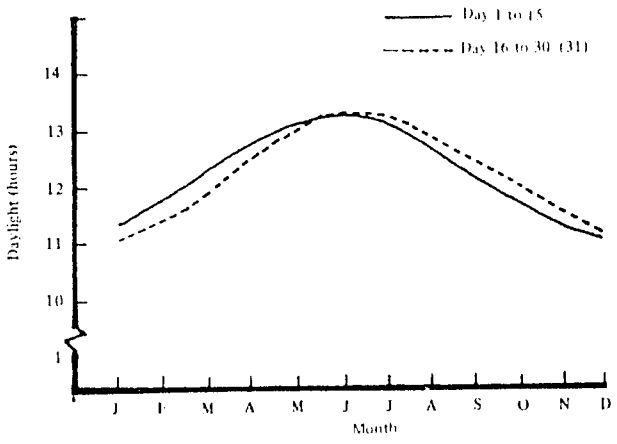
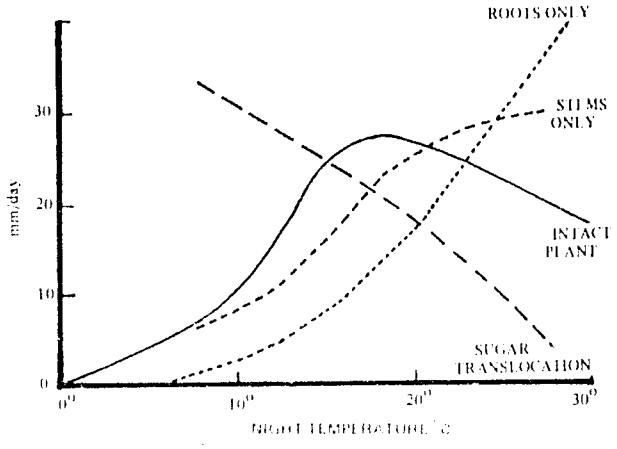


Duration of daylight for various half-months in the Philippines (Rose, 1966)



Rates of different processes plotted as a function of the night temperature for tomato plant cuttings (Went, 1968)

Temperature

Temperature determines the distribution of plants or crops that can be produced successfully in different regions of the world. It controls the rate of photosynthesis and respiration and influences flowering, maturity, and distribution.

Extremes of temperature adversely affect physiological processes and inhibit plant growth. Within a favorable temperature range, plants grow faster as temperature increases, provided other environmental factors such as nutrients, water, and light are not limiting.

Different crops and even varieties of the same species require specific temperature ranges for best performance. Tropical species, for example, can better tolerate the high temperatures in the tropics than temperate or cool-season crops. Conversely, cool-season crops can withstand lower temperatures.

Not only the absolute temperature but also the daily change in temperature affects the plant response. This is particularly true with tomato and potato wherein the night temperature is critical for normal development. On the other hand, the temperature required for normal growth or for production of highest marketable yield varies with stage of development.

Table 6 shows the optimum or favorable temperature range for the growth and development of various crops grown in the Philippines. The remarks column explains the temperature requirement and/or describes the response of the crops at temperature below or above the optimum range.

In using the table, bear in mind that temperature requirements differ among varieties within species and temperature responses are modulated by light intensity and moisture levels.

Table 6. Temperature requirements of crops grown in the Philippines

Crops	Temperature Requirements (°C)	Remarks	References
Abaca	20-25	The optimum temperature requirement has not been fully determined. Since abaca is easily damaged by excessive heat, it should be grown in a relatively cool environment. However, it can tolerate a temperature of 29°C.	Tabora and Santos (1978) Anunciado, *et al.* (1977)
African oil palm	24-27	Optimum temperature. Requires a rainy tropical climate.	Godin and Spensley (1971)
Arrowroot	—	Most productive in a hot, moist climate. It normally grows from sea level to about 900 m but does particularly well at elevations of 60-90 m.	Kay (1973)
Banana	15-35	Bananas are essentially plants of the humid tropics. Ideal mean temperature is about 27°C. Optimum temperature range is 25-30°C.	Tai (1977) Simmonds (1966) Doorenboos and Kassam (1979)
Black pepper	—	Grows best on hot, humid, tropical climates at low altitudes.	Purseglove (1973) Anunciado (1969)
Cabbage	16-18 24 (max)	Thrives best on a cool, moist climate. Heat tolerant varieties can be grown successfully in lowland tropics during warm months. Exposure of plants that have formed heads to a mean temperature of about 4.4°C for 6-8 weeks will induce flowering.	Bantoc (1967) Boswell and Jones (1941)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
Cacao	21-35	In representative cacao growing areas in Brazil, Trinidad, Ghana, Nigeria, Costa Rica Ecuador, and Cameroon, annual mean temperature ranges from 22.4-26.7, while the monthly means vary from 18.8-27.9°C. Lower temperature limiting the successful growth is a mean monthly minimum of 15°C and an absolute minimum of 10°C.	Batal, *et al.* (1979) Alvim (1977)
Carrot	16-21	Yields are low at 4-10°C but gives the best color and highest carotene conter'. Temperature at 21-27°C is too hot for normal growth.	Boswell and Jones (1941) Tisbe (1967)
Cashew	15-25[a] 25-35[b]	Cashew is sensitive to frost and prefers high temperatures. Low temperature probably retards bud break. It is cultivated between 27°N and 28°S latitude. Optimum temperature is 27°C.	Nambiar (1977) Ohler (1969, 1979)
Cassava	25-29	Growth stops at a temperature of around 10°C and yields are reduced at temperatures above 29°C. Tuberization appears to be stimulated by low temperature.	Kay (1973) Wilson (1977) Kassam (1976)
Castor oil palm	--	Does best where temperature is fairly high throughout the growing season. If it stays above 38°C for an extended period, the seed may fail to set. It needs a hot, dry climate for proper development of fruits and seeds, and for harvesting.	Godin and Spensley (1971) Bantoc (1967)
Cauliflower	16-18 24 (max)	Much less tolerant of extreme heat or cold and other adverse conditions as cabbage. High temperatures cause leafy, loose, ri	Boswell and Jones (1941) Bantoc (1967)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
		yellowed curds of inferior quality. Some varieties can be grown successfully on the lowland tropics during warm months.	
Celery	16-18	Chilling the plants at temperatures of 4.4-10°C for 10 days or longer favors seed-stalk formation. Temperatures at 21-27°C prevent normal vegetative growth and the development of high quality.	Boswell and Jones (1941)
Chayote	18-24 32-35 (max)	For successful growth, a long period of warm preferably dry weather is required. Extreme tolerant temperature range is 12-32°C.	Knott and Deanon (1967) Tisbe, *et al.* (1967)
Chinese cabbage	20-25	During head formation, a day temperature of 21°C and a night temperature of 16°C are required. Extreme tolerant temperature range is 12-32°C.	Tu (1978)
Chinese water chestnut	—	Requires a long warm growing season. A soil temperature of 14-15.5°C is required for germination of corms.	Kay (1973)
Citrus	13-35	Most citrus species make little or no shoot elongation at temperature near 12 or 13°C. Extreme temperatures accompanied by low relative humidity are often injurious. Young fruits and leaves are particularly sensitive. Optimum temperature range is 23-30°C.	Doorenbos and Kassam (1979) Reuther (1977) Platt (1973)
Coconut	27 (ideal with a diurnal range of 6-7°C)	Grows throughout the tropical world between latitudes 23°N and 23°S. Nuts cannot form if the weather stays cold (less than 20°C) for a long time. It can be grown at altitudes up to 1,520 m provided the mean	Murray (1977) Godin and Spensley (1971) Woodroof (1970) Lambert (1970)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
		and annual temperatures are within 22°-31°C. Optimum temperature range is 24-29°C.	
Coffee			
Arabica	15.6-21.1 23.9 (max)	Grows best under relatively humid and cool environment provided there are no cold winds or frosts. It requires fairly high elevation. It is a mountain crop growing best on steep slopes.	Haarer (1963) Wellman (1961) Maestri and Barros (1977)
Liberica	—	More likely to become adapted as a lowland coffee than Canephora (Robusta) or Arabica.	Wellman (1961)
Robusta	18.3-26.7 29.4 (max)	Cannot withstand cold winds or dry hot winds. But it can withstand warmer temperature than Arabica.	Haarer (1963)
Common bean	16-24 10 (min) 30 (max)	Requires warmer climate than peas. Very high temperatures lower yield due to blossom drop. Optimum soil temperature for germination is 16-29°C.	Kay (1979) Meiners and Kraft (1977) Hill (1952)
Corn	18-24 32-35 (max)	Essentially a warm season crop. Temperature at 38°C plus water stress at tasselling and silking prevent seed set. Temperature as low as 15.6°C greatly retards flowering and maturity.	Knott and Deanon (1967) Gaudiel and Aquilizan (1967) Jenkins (1941) Wann (1977)
Cotton	25°C or more	Sensitive to strong or cold winds. It requires a temperature of 27-43°C for boll development.	Brown (1958) Doyle (1941) Doorenbos and Kassam (1979)
Cowpea	20-35	High night temperature hastens the onset of flowering, but its effect can be offset by long days in photoperiodic plants. Yields are liable to be reduced at temperatures above 35°C because of flower and pod shedding.	Knott and Deanon (1967) Kassam (1976) Meiners and Kraft (1977) Kay (1979)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
Cucumber	18-24 32-35 (max)	For successful growth, a long period of warm preferably dry weather is required.	Knott and Deanon (1967) Tisbe, *et al.* (1967) Boswell and Jones (1941)
Durian		Grows in humid lowland areas in the tropics below 800 m elevation.	NAS (1975a)
Eggplant	25-35 (day) 20-27 (night)	A warm season vegetable adapted for year round production in the tropics. It is more tolerant to hot night temperature than tomato.	Martin and Pollack (1979)
Garlic	13-24	Succeeds best in a mild season without great extremes of heat, cold, and excessive rainfall. Exposure of dormant cloves, or growing plants to cool temperatures (below 20°C) under long days favors bulb formation. However, prolonged exposure may initiate the formation of rough bulbs. High temperatures hasten bulbing and maturity.	Boswell and Jones (1941) Deanon and Cadiz (1967) Jones and Mann (1963)
Ginger	20-30	Indigenous to the tropic and susceptible to frost injury. Young plants are very susceptible to sunburn when temperatures exceed 32°C. It grows even at high elevations.	Purseglove (1973) Groszmann (1954) Mendiola (1958)
Grapes	15-30	Little growth takes place at temperatures of less than 10°C. Wine grapes thrive well where summer temperatures are frequently above 38°C. Muscadine varieties require long, warm growing season to mature. Optimum temperature range is 20-25°C.	Doorenbos and Kassam (1979) Godin and Spensley (1971) Magness and Traub (1941)
Greater yam	25-30	A plant of the hot humid tropics. It seldom occurs where cool temperature or	Kassam (1976) Kay (1973) Martin (1976)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
		dry periods prevail during the growing season.	
Lablab bean	20-30 35 (max)	There are varieties for warm, temperate, subtropical, and humid rainforest regions where mean summer temperatures range from 22-35°C. There are also varieties for lowlands and highlands.	Knott and Deanon (1967) NAS (1979)
Lanzones	—	Adapted to tropical conditions.	Almeyda and Martin (1977)
Lesser yam	25-30	A truly tropical plant. High temperature favors growth.	Kassam (1976) Kay (1973)
Lettuce	15-20	Head lettuce has a very narrow range of adaptability. Temperature of 21-27°C prevents heading and seeding of plant shoot. At high temperatures, the leaves become tough and bitter.	Bantoc (1967) Boswell and Jones (1941)
Lima bean	16-27	At temperatures above 32-35°C, serious blossom shedding and pod drop can occur. Unselected viny varieties perform well in the humid lowland tropics. Early maturing nonviny varieties yield poorly at temperatures above 27°C.	Kay (1979) NAS (1979) Meiners and Kraft (1977)
Mango	24-27	Tolerates a wide range of climate. It is well-adapted to tropical and subtropical climate. Minimum endurance temperature range is 1-2°C. High temperature is not as injurious as low temperature, but if accompanied by low humidity and strong winds, it affects the trees adversely.	Singh (1977)
Mangosteen	20-30	Thrives best on warm, humid, rainy climate with few seasonal variations in rainfall	NAS (1975c) Almeyda and Martin (1976)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
		and temperature. Suffers severe damage when the temperature goes below 5°C.	
Mungbean	20-30 28-34 15-23	Optimum temperature. Mean maximum temperature. Extreme tolerant temperature.	Tu (1978)
Muskmelon	18-24 32-25 (max)	For successful growth, a long period of warm preferably dry weather is required. Fruits ripen very slowly during cool nights.	Tisbe, *et al.* (1967) Smith (1956) Boswell and Jones (1941) Davis, *et al.* (1953)
Okra	20-30 35 (max)	High temperatures are necessary for seed germination and growth. Okra is out of place and unproductive in cool highlands.	Knott and Deanon (1967) Martin and Ruberte (1978)
Onion	13-24	Succeeds best in a mild season without great extremes of heat, cold, and excessive rainfall. During the early stages of growth, cool temperatures should prevail. But during bulbing, warm temperatures are desirable. Cool temperatures (4.5-14.0°C) induce bolting.	Deanon and Cadiz (1967) Jones and Mann (1963) Boswell and Jones (1941) Bautista and Cadiz (1967)
Papaya	21-33 (daily mean temperature)	A tropical plant, it prefers warm areas. In the tropics, commercial production of high grade fruit is found in plantings below an elevation of 1000 m. Cool weather reduces growth and yield and has unfavorable effect on fruit flavor.	Pantastico, *et al.* (1977)
Pea	10-23	A cool but not excessively cold climate is required. Optimum temperature for germination is 24°C. A temperature as high as 27°C causes premature ripening and lowers seed quality and	Kay (1979) Doorenbos and Kassam (1979) Deanon and Soriano (1967) Thompson and Kelly (1957)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
		yield. Optimum temperature range is 13-18°C.	Boswell and Jones (1941)
Peanut	24-33	Extreme differences between day and night temperatures of more than 20°C tend to limit flowering. Night temperatures below 10°C delay maturation. Optimum temperature for germination is 32-34°C.	Kassam (1976) Rachie and Roberts (1974)
Pepper	16-23 28 (max)	More tolerant of extreme heat and dryness than either eggplant or tomato. Night temperatures less than 16°C and above 32°C prevent fruit set. It can be grown anywhere in the tropics at any time of the year except in high mountainous regions with alpine climate.	Deanon (1967) Knott and Deanon (1967) Martin, *et al.* (1979)
Pigeon pea	18-29	May be grown in areas with average temperatures as high as 35°C provided there is adequate moisture.	Kay (1979)
Pineapple	30 (day) 20 (night)	High temperature coupled with high insolation result in sunburn to leaves and fruit. In the tropics, pineapple is restricted to the relatively lower elevations. Growth activity ceases when soil temperature drops below 20°C.	Bartholomew and Kadzimin (1977) Collins (1960)
Potato	10-25 15-18 (temperate, long-day cultivars)	A cool night temperature (10-14°C) appears to be more important than a cool daytime temperature. Response to temperature can be modified by light intensity and daylength. Cultivars suited for the tropics have a much wider temperature tolerance than temperate cultivars.	Kay (1973) Balaoing, *et al.* (1979) Opeña (1978) Doorenbos and Kassam (1977) Wilson (1977) Kassam (1976)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
Pummelo	—	Ideally suited to the vast land tropical zone where the uniformly warm climates reduce the quality and yield of other citrus species. Most tropical in adaptation among the citrus fruits.	NAS (1975a) Martin and Cooper (1977)
Radish	15	Requires cool, humid climate. Most cultivars are very tolerant to higher temperatures. Good yields are obtained in the tropics in areas with minimum monthly temperature of 19-22°C and a maximum of 30-33°C.	Kay (1973)
Rambutan	—	Strictly tropical in adaptation. It is seldom successful in the subtropics.	Almeyda, *et al.* (1979)
Ramie	—	Grows on many regions with climate ranging from tropical to temperate. Multiple harvests are possible only with steady, high temperatures, humid atmosphere, and well-distributed rainfall.	NAS (1975a)
Rice	18-40 25-30 25-31 30-33 20-29	For germination. For seedling emergence and establishment. For tillering. For anthesis. For ripening.	Yoshida (1977)
Rubber	26-28	Cultivation is concentrated between 10°N and 10°S latitude. Beyond an altitude of 200 m, there is a 6-month delay in reaching tappable trunk size for each 100 m increase in altitude. Lower limit of thermal adaptation is 20°C.	Jacob and Uexkull (1960) Moraes (1977)
Sesame	25-27	Temperatures below 18-20°C inhibit germination and	Kassam (1976)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
		growth. Low temperature at flowering can cause pollen sterility and flower drop while temperatures above 40°C reduce fertility and capsule set.	
Sorghum	26.7-29.4	Minimum temperature for germination ranges from 7.2-10°C and for subsequent growth is 15.6°C. Temperatures above 38°C are harmful especially when the plants are approaching the heading stage. Can tolerate heat and dry conditions better than corn.	Martin (1941) Kassam (1976)
Soursop	—	Adapted only to lowland areas. It is widely planted in the tropics below an altitude of 1,000 m. It does not tolerate dry, cold winds and produces few fruits in chilly mountainous areas.	NAS (1975a)
Soybean	22-30	Most varieties thrive on fairly warm day and night temperatures. Night temperatures of around 13°C greatly retard development.	Godin and Spensley (1971) Tu (1978)
Squash pumpkin	18-27 32-35 (max)	For successful growth, a long period of warm preferably dry weather is required.	Tisbe, *et al.* (1967) Knott and Deanon (1967) Boswell and Jones (1941)
Strawberry	—	Varieties have been selected that can be grown in tropical highlands and in northern latitudes where very severe winter conditions prevail.	Magness and Traub (1941)
Sugarcane	24-27°C or more	Requires a long warm growing season and a fairly dry, sunny and cool ripening and harvesting season. Optimum temperature for the sprouting	Kassam (1976) PHILSUGIN (1975) Halliday (1956) Nickell (1977)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
		of setts is 32-38°C. It is widely grown within 30°N and 30°S of the equator. Growth is only active above 20°C.	
Sunflower	15-30	Requires moderately warm climate. Thrives in the tropics at medium to high elevations and under suitable conditions in temperate climates. Optimum temperature range is 18-25°C.	Doorenbos and Kassam (1979) Godin and Spensley (1971)
Sweet orange	22.8-32.8	Requires subtropical climate with cool winters and warm summers. High elevation areas in the Philippines approximate subtropical conditions and may be suited for orange production. Chilling temperatures at 15°C or lower favor the development of a bright orange rind.	Magness and Traub (1941) NAS (1975a) Reuther (1977) Coronel, *et al.* (1980)
Sweet potato	24°C or more	Requires a warm growing period of at least 3 months. Low nighttime temperature (20°C) promotes tuberization. The plant is damaged by temperatures below 10°C but is more tolerant to cold than many other tropical root and tuber crops. It can be grown at altitudes as high as 3,000 m.	Cadiz and Bautista (1967) Wilson (1977) Kay (1973) Coursey and Booth (1977) Kassam (1976)
Tannia	20-30	Grows best at low to medium altitudes in the humid (frost-free) tropics. In Puerto Rico tannia is successfully grown on areas where the mean annual temperature is 24°C with maximum variations ranging from 13-29°C.	Kassam (1976) NAS (1975a) Kay (1973)
Taro	21-27	Requires hot, humid conditions. In more temperate areas or at high altitudes, there must be a 6-7 month frost-free period.	Kay (1973)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
Tobacco	15-35	Temperatures above 35°C on bright days may result in considerable scalding of leaves. Low temperatures below 13°C are undesirable. *Nicotiana rustica* is adapted for growth in cool climate. Optimum temperature range is 20-30°C.	Kassam (1976) Quimio, *et al.* (1979) Akehurst (1968) Doorenbos and Kassam (1979)
Tomato	26-32 25-26 22-27 18-20 24-28	For seed germination. For seedling growth. For pollen germination and pollen tube growth. For fruit set (intact plant). For fruit ripening. Temperature responses are modulated by light intensity, mineral nutrient, and moisture level.	Aung (1979)
Vanilla	27	Optimum temperature for growth.	Pursegiove (1973)
Watermelon	21-29 35 (max)	Most productive in areas with long, warm growing season.	Tisbe, *et al.* (1967) Knott and Deanon (1967) Doolittle, *et al.* (1962)
Wax gourd	—	Grows well throughout the Asian tropics.	NAS (1975a)
Wheat	10-25	Requires cool weather during tillering and early growth stages. Wheat is not a strictly tropical crop. Optimum temperature range is 15-20°C.	Doorenbos and Kassam (1979) Kassam (1976) Jacob and Uexkull (1960)
Winged bean	20-30 35 (max)	Although reported to grow at latitudes of up to 2,000 m in Papua, New Guinea, the crop is better suited to tropical lowlands.	Knott and Deanon (1967) Martin and Delpin (1978)

Table 6. (Continued)

Crops	Temperature Requirements (°C)	Remarks	References
Yam bean	20-30 35 (max)	Grows well in regions ranging from subtropical to tropical and dry to wet. To obtain good yields, yam bean requires a hot climate with moderate rainfall.	Knott and Deanon (1967) NAS (1979) Kay (1973)
Yardlong bean or sitao	20-30 35 (max)	Like cowpea, yardlong bean likes warm weather.	Knott and Deanon (1967)

[a]Mean daily minimum temperature range in most important cashew-producing regions of the world
[b]Mean daily maximum temperature range in most important cashew producing regions of the world

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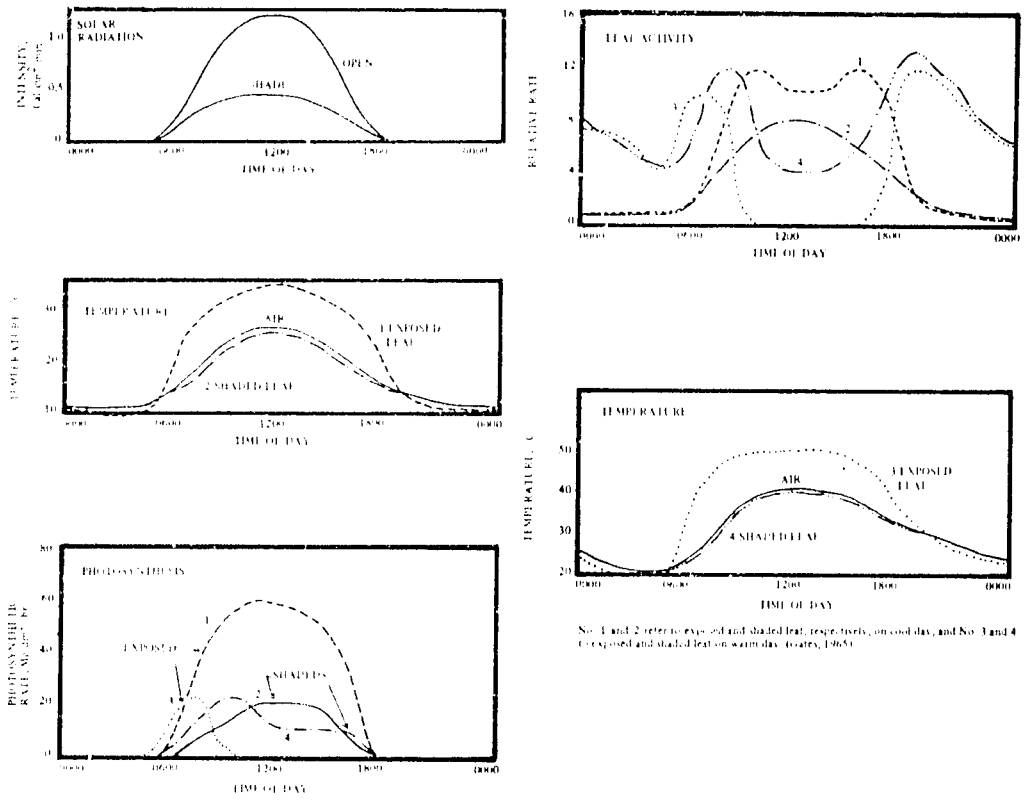

Nos. 1 and 2 refer to exposed and shaded leaf, respectively, on cool day, and Nos. 3 and 4 to exposed and shaded leaf on warm day (Yoshida, 1965).

Light

All aspects of plant growth and development are controlled by light. Light affects the type of growth, synthesis of food materials, differentiation of tissues and organs, and maturity of various crops. The critical aspects of light as environmental factor are light intensity and light duration or daylength. To some extent, a grower can modify light conditions for his crops by manipulating plant spacing and arrangement, using shading materials or structures, and providing additional light.

Photosynthesis cannot take place without light. Light supplies energy for the conversion of carbon dioxide and water into energy-rich organic compounds. The rate of photosynthesis increases with light intensity almost linearly over a narrow range until the light saturation point where photosynthesis becomes independent of light intensity.

Carbohydrate accumulation is associated with high light intensity. Thus, when temperature and soil moisture are at optimum levels, crop yields in the Philippines are higher during the dry than the rainy season when light intensity is much reduced.

The favorable light intensity range varies with the kind of plant. Certain plants thrive in full sun and would not survive in shade, while other plants thrive in shade and would not survive in full sun. Table 7 shows the light requirements of some

crops grown in the Philippines. Published data on the light requirements of crops adapted to the tropics are rather limited, thus several crops grown in the country were not included in the table. However, several economically important crops such as mango, coconut, cassava, and mungbean are known to perform best under full sun.

Daylength or photoperiod is a major environmental factor in the control of flowering. It also controls bulbing, tuber formation, and other aspects of plant growth. Response to the length of light and dark periods is called photoperiodism and it does not depend on light intensity. The Philippines lies a little way above the equator so it is not subjected to wide fluctuations in daylength.

Based on their photoperiodic response, the majority of plants are classified as short day, long day, or day neutral. Other categories are nonobligate and long day-short day plants. Short day or long night plants require a dark period exceeding some critical length to induce flowering. They do not flower under continuous illumination. On the other hand, long day or short night plants are inhibited from flowering when the dark period exceeds some critical length, but they flower under continuous illumination. Day neutral plants apparently will flower over a wide range of daylength. Nonobligate plants will flower regardless of the daylength but will flower earlier or more profusely when the day is either long or short. Long day-short day plants flower only after an alteration of daylengths. These plants require first an exposure to long days and then to a period of short days. Daylength, however, does not have exclusive control over flowering since photoperiodic response can be modified by temperature.

The critical daylength varies with the photoperiodic response of plants. With short day plants, the maximum daylength favors flowering and it generally varies from 11-14 hours. With long day plants, the critical daylength seems to be from 12-14 hours which is the minimum daylength at which the plant differentiates its flower buds. The length of the dark rather than the light period is the critical factor in photoperiodic response. Short day plants generally require 10-14 hours of continuous dark to form flower buds and develop flowers, fruits, and seeds while long day plants require 8-10 hours.

Table 8 presents the daylength or photoperiodic response of some crops grown in the Philippines. It could serve as guide in determining the crops or varieties adapted in a given location and the best time to grow them so as to attain the highest marketable yield. With day neutral crops or varieties, the daylength during the growing season does not limit production. They can be grown all year round provided all other factors are favorable. With photoperiod sensitive crops or varieties, however, flowering may be stimulated, prevented, or delayed by the daylength prevailing at the time of the year the crops are growing. It should be mentioned here that the effect of daylength on flowering is not always beneficial. Flowering in sugarcane, for example, lowers yield.

Data on critical daylengths of several crops or varieties adapted to the country are rather limited so the information presented in Table 8 is far from complete.

Table 7. Light requirements of crops grown in the Philippines

Crops	Light Requirements	References
African oil palm	A sun loving plant which does not thrive or yield well in dense formations or when overshadowed.	Godin and Spensley (1971)
African violet (Saint Paulia)	Requires shade only and no direct sun. Optimum light intensity range: 5.4-10.8 klux (500-1000 ft-c).	Edmond, *et al.* (1975)
Banana	Requires exposure to full sunlight, but sunburn of fruit can result from exposure to high light intensity especially when accompanied by high temperature. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Tai (1977)
Begonia	Requires shade only and no direct sun. Optimum light intensity range: 5.4-10.8 klux (500-1000 ft-c).	Edmond, *et al.* (1975)
Black pepper	Requires at least partial shade, especially when grown in areas where there is a relatively long dry season. Optimum light intensity range: 10.8-32.3 klux (1000-3000 ft-c).	Hill (1952) Edmond, *et al.* (1975) Anunciado (1969)
Cabbage	Tolerant to slight shade and direct sun. Optimum light intensity range: 21.5-86.1 klux (2000-8000 ft-c).	Edmond, *et al.* (1975)
Cacao	After passing the juvenile stage, or when the leaf canopy is sufficiently developed to provide self shading, cacao production is usually higher with little or no shade than when the plants are shaded. Optimum light intensity range: 10.8-32.3 klux (1000-3000 ft-c).	Alvim (1977) Edmond, *et al.* (1975)
Cashew	Extremely sensitive to light and produces more foliage, flowers, and fruit on exposed than on shaded branches. Does best with a high number of hours of sunshine throughout the year.	Nambiar (1977) Ohler (1979)
Chrysanthemum	Requires direct sun mostly. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Edmond, *et al.* (1975)
Citrus	Shading reduces ascorbic acid content of the fruits. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Magness and Traub (1941) Edmond, *et al.* (1975)
Coffee	In places where humidity is often high, coffee can be grown without shade. Coffee needs shade in regions of high	Haarer (1963) Maestri and Barros (1977)

Table 7. (Continued)

Crops	Light Requirements	References
	temperature. Optimum light intensity range: 10.8-32.3 klux (1000-3000 ft-c).	Edmond, *et al.* (1975)
Corn	Requires abundant sunshine for maximum yields. It fails to grow normally in the shade, or during extended periods of cloudy weather. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Jenkins (1941) Wann (1977) Edmond, *et al.* (1975)
Cotton	Requires sunny weather. Sunshine is especially important when the plants are in bloom. Optimum light intensity range: (3000 8000 ft-c).	Brown and Ware (1958) Doyle (1941) Edmond, *et al.* (1975)
Cowpea	Requires warm sunny climate. Under reduced light intensity, the plant becomes etiolated and assumes a climbing habit.	Deanon and Soriano (1967) Rachie and Roberts (1974)
Cucurbits	Need maximum sunshine for best development. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Whitaker (1977) Edmond, *et al.* (1975)
Muskmelon	Bright days, low humidity, and high temperature combined will produce fruits with high sugar content, firm flesh, and fine flavor. If the weather is cloudy or rainy during the ripening period, melons are likely to become tasteless.	Boswell and Jones (1941) Tisbe, *et al.* (1977) Davis, *et al.* (1953) Smith (1956)
Diffenbachia	Requires shade only and no direct sun. Optimum light intensity range: 5.4-10.8 klux (500-1000 ft-c).	Edmond, *et al.* (1975)
Eggplant	Requires direct sun mostly. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Edmond, *et al.* (1975)
Ferns (most species)	Require shade only and no direct sun. Optimum light intensity range: 5.4-10.8 klux (500-1000 ft-c).	Edmond, *et al.* (1975)
Ginger	Partial shading is desirable. It performs best when grown under slight shade but not in excess of 50% shading.	Hill (1952) Aclan and Quisumbing (1976)
Gladiolus	Requires direct sun mostly. Optimum light intensity range: 32.3-86.1 klux (3000-800 ft-c).	Edmond, *et al.* (1975)
Grapes	The highest quality of fruit is associated with abundant sunshine during the	Magness and Traub (1941)

Table 7. (Continued)

Crops	Light Requirements	References
	growing season. A reduction in light intensity (or temperature) by shading reduces flower bud initiation.	Salter and Goode (1967)
Kalanchoe	Requires direct sun mostly. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Edmond, *et al.* (1975)
Lima bean	Requires warm sunny climate.	Deanon and Soriano (1967)
Mangosteen	Partial shade is desirable during the first year of growth. With time, trees no longer need shade. Trees without shade can develop normally and bear earlier than shaded trees.	Almeyda and Martin (1970)
Orchids		
Arachnis-renanthera type	More tolerant to full sunlight than dendrobium and cattleya. Some varieties are not productive if grown under shade, but there are hybrids and species that need partial shade.	Valmayor, *et al.* (1977)
Cattleya and its allies	May be grown under full sun provided that they are protected from intense heat and light at noontime. For the commercial grower, a slat house with about 30-50% shade is necessary.	Valmayor,*et al.* (1977)
Dendrobium	Many dendrobiums can survive under full sunlight but their growth is very poor. Use of a shading material that allows 50-60% of the sunlight to reach the plant is desirable.	Valmayor, *et al.* (1977)
Phalaenopsis	Needs lower light intensity than other commercial flowering orchids. Sunlight exposure favorable for phalaenopsis ranges from 50-75% for the mature plants and less for the seedlings.	Valmayor, *et al.* (1977)
Strap-leaf vandas/ ascocendas	Require a slat house with reduced light intensity. Young seedlings should be grown at about 5.4-8.6 klux (500-800 ft c). Older seedlings can be exposed to more sunlight provided the leaves do not get scorched.	Valmayor, *et al.* (1977)
Semi-terete vandas/ ascocendas	Seedlings are handled just like strap-leaf vandas and then gradually exposed to more sunlight until they become adjusted to open culture.	Valmayor, *et al.* (1977)

Table 7. (Continued)

Crops	Light Requirements	References
Terete-vandas	Should be grown under full sun.	Valmayor, *et al.* (1977)
Papaya	Requires direct sun mostly. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Edmond, *et al.* (1975)
Peanut	Requires plenty of sunshine. Reduced light and shading tend to inhibit growth and fruit formation particularly during the early stages of development. Optimum light intensity range: 21.5-86.1 klux (2000-8000 ft-c).	Rachie and Roberts (1974) Edmond, *et al.* (1975)
Pepper (Sweet)	Requires direct sun mostly. Optimum light intensity range: 5.4-10.8 klux (3000-6000 ft-c).	Edmond, *et al.* (1975)
Philodendron	Requires shade only and no direct sun. Optimum light intensity range: 5.4-10.8 klux (500-1000 ft-c).	Edmond, *et al.* (1975)
Pigeon pea	Bright sunshine is essential for optimum seed yields since excessive cloud or shade produces spindly growth and poor seed set.	Kay (1979) Deanon and Soriano (1967)
Pineapple	High percentage of cloudy days retards growth and results in small fruits of poor quality. Too much sunshine may cause sunburn damage to nearly mature fruits. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Collins (1960) Edmond, *et al.* (1975)
Poinsettia	Requires direct sun mostly. Optimum light intensity range: 32.2 86.1 klux (3000-8000 ft-c).	Edmond, *et al.* (1975)
Potato	Tolerant to slight shade and direct sun. Optimum light intensity range: 21.5-86.1 klux (2000-8000 ft-c).	Edmond, *et al.* (1975)
Rice	Requires direct sun mostly. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Edmond, *et al.* (1975)
Rose	Requires direct sun mostly. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	Edmond, *et al.* (1975)
Sugarcane	Well-known "sun-loving" plant; a C_4 plant. Saturation light intensity is reported to be 64.6 klux (6,000 ft-c).	Nickell (1977) Jen-Hu Chang (1968)
Sweet potato	Requires abundant sunshine with a minimum of cool cloudy weather for optimum	Kay (1973) Edmond, *et al.*

Table 7. (Continued)

Crops	Light Requirements	References
	growth. Optimum light intensity range: 32.3-86.1 klux (3000-8000 ft-c).	(1975)
Tobacco	Low light intensity and high temperature can lead to the production of thin leaves. Cigar wrapper tobacco is usually grown under shade. Optimum light intensity range for certain varieties: 32.3-86.1 klux (3000-8000 ft-c).	Kassam (1976) Quimio, *et al.* (1979) Edmond, *et al.* (1975)
Tomato	Fruits contain higher ascorbic acid under high light intensity.	Thompson and Kelly (1957)
Vanilla	Usually grow up living trees which have low branches and provide light shade. Optimum light intensity range: 10.8-32.3 klux (1000-3000 ft-c).	Purseglove (1973) Edmond, *et al.* (1975)
Wheat	Saturation light intensity is reported to be 57 klux (5300 ft-c).	Jen-Hu Chang (1968)
Winged bean	Requires warm sunny climate.	Deanon and Soriano (1967)
Yardlong bean	Requires warm sunny climate.	Deanon and Soriano (1967)

[a] C_4 Plants have the following general characteristics:
optimum temperature range for photosynthesis — 30-40°C
saturation light intensity — 64.6 + klux (6000 + ft-c)
rate of transpiration — low
rate of net photosynthesis at high temperature and light intensity — high
Other C_4 plants are corn, sorghum, and coastal bermuda

Table 8. Daylength response of crops grown in the Philippines

Crops	Daylength Response	References
Banana	There is no evidence of photoperiodic response.	Tai (1977)
Cashew	Cashew might be expected to display equatorial behavior (equal day and night length most favorable). Flowering is more influenced by the occurrence of rainy and dry seasons than by daylength.	Ohler (1979)
Cassava	Short days stimulate tuberization. It is less productive of tuberous roots in daylengths greater than 10-12 hours. Short days also hasten flowering. Most productive when grown in areas between 15°N and 15°S latitude.	Kassam (1976) Kay (1973) Wilson (1977)

Table 8. (Continued)

Crops	Daylength Response	References
Castor oil plant	Basically a long-day plant but adaptable, with some loss of yield, to a fairly wide range of daylength.	Godin and Spensley (1979)
Chayote	Flower initiation occurs at a daylength of about 12 hours, thus production can occur throughout the year in the tropics.	Tisbe, *et al.* (1967)
Citrus	Daylength probably has minor or no effect on flower induction.	Magness and Traub (1941)
Coconut	Daylength is not critical.	Godin and Spensley (1971)
Coffee	Apparently a short-day plant. Response of trees to daylength may be conditioned by temperature and rainfall.	Maestri and Barros (1977)
Corn	Response is not so pronounced, but the times of flowering and ripening are modified by daylength. The period from emergence to flowering is reduced by short days and increased by long days.	Jenkins (1941)
Cowpea	Short-day, day-neutral, and long-day types exist. Optimum photoperiod for flower induction ranges from 8-14 hours. The prevailing daylength in the Philippines is ideal.	Kay (1979) Deanon and Soriano (1967)
Cucumber	Not very sensitive to daylength differences that occur under field conditions.	Boswell and Jones (1941)
Eggplant	Apparently not sensitive to daylength differences. It can grow and flower freely year round.	Martin and Pollack (1979)
Garlic	Long and cold treatment favors bulbing. Garlic grown in tropical and subtropical areas may fail to bulb due to short daylength and lack of cool temperature.	Jones and Mann (1963)
Kenaf	A short-day plant.	Kassam (1976)
Lablab bean	Short-day, long-day, and day-neutral cultivars exist.	Kay (1979)
Lettuce	Photoperiod has little effect on either growth or stalk development.	Bantoc (1967)
Lima bean	Some cultivars long established in the tropics and wild plants originating in the Caribbean area are short-day plants.	Kay (1979)

Table 8. (Continued)

Crops	Daylength Response	References
	Cultivars originating in more temperate zones are day-neutral.	
Mungbean	Although often classified as a short-day plant, day-neutral cultivars also exist.	Kay (1979)
Okra	Short days stimulate early flowering and reduce vegetative growth. But the 'Clemson Spineless' variety is almost unresponsive to daylength.	Martin and Ruberte (1978)
Onion	All cultivars of the common onion are long-day plants with respect to bulb formation — they bulb more readily as daylengths increase. Critical daylength varies from about 12-16 hours depending on the cultivar. Photoperiod has little effect on the initiation of flowers	Jones and Mann (1963) Voss (1980)
Peanut	Flower initiation is largely unaffected by daylength. However, some works suggest that sensitivity to daylength depends on temperature.	Rachie and Roberts (1974) Kassam (1976)
Peppers	Day neutral or almost so. Thus, they can be grown throughout the year in the tropics.	Martin, *et al.* (1979)
Pigeon pea	Short-day, day-neutral, and intermediate forms have been identified. Most established cultivars are short-day plants and sowing date is critical.	Kay (1979)
Pineapple	Daylength is considered to be a factor in the flowering of 'Smooth Cayenne' and 'Cabezona' but not of 'Red Spanish'. 'Smooth Cayenne' grown in Hawaii is a quantitative, but not an obligate, short-day plant.	Bartholomew and Kadzimin (1977)
Potato	Response to daylength is a varietal characteristic. Some varieties produce reasonable yields with a daylength 12-13 hours. Others require 15-16 hours; some produce reasonable yields under long- or short-day conditions.	Balaoing, *et al.* (1979) Kay (1973)
Radish	Photoperiodic response varies with cultivar. Many red-flesh types require long days to produce flowers and seeds.	Kay (1973)
Rice	A short-day plant with a critical daylength of 12-14 hours. Nearly all varieties mature in a shorter time under a short	Vergara, *et al.* (1972)

Table 8. (Continued)

Crops	Daylength Response	References
	photoperiod (about 10 hours) than under a long (14 hours), but the degree of sensitivity varies greatly among varieties. Optimum photoperiod for photoperiod-sensitive varieties is 10 hours.	
Sesame	Basically a short-day plant, although long-day types also exist. Some appear to be less sensitive to photoperiod. Critical daylength is 12 hours or less.	Godin and Spensley (1971) Kassam (1976)
Sorghum	Heading and flowering are hastened by short days and delayed by long days. Most varieties from the tropics when grown in the United States will not head because summer days are too long (14 hours or more). Some varieties, however, will head and develop mature grain even with daylength as long as 16 hours.	Martin (1941)
Soybean	A short-day or day-neutral plant. Critical daylength is 13 hours or less in "late" varieties.	Godin and Spensley (1971) Kassam (1976)
Sugarcane	Most *Saccharum* varieties will not flower under daylengths longer than 13 hours or shorter than 12 hours. Sensitivity to photoperiod depends on the variety. The response is modified by environmental factors; 12.5 hours + 20-25°C night temperature will induce floral initiation.	Kassam (1976)
Sunflower	Daylength is not critical.	Godin and Spensley (1971)
Strawberry	At temperature above 19.4°C, strawberry behaves as a short-day plant and will not initiate flowers in daylengths longer than 12 hours. Below 19.4°C, it behaves as a day-neutral plant and will initiate flowers even in continuous illumination.	Janick, *et al.* (1969)
Sweet potato	Short days with low light intensity promote root development; 11 hours or less promotes flowering. At 13 ½ hours, flowering ceases but tuber yields seem unaffected.	Kay (1973)
Taro	Short days stimulate tuberization.	Wilson (1977)
Tobacco	Cultivated tobacco is day-neutral although 'Maryland Mammoth' flowers only when exposed to short days.	Kassam (1976) Akehurst (1968) Evans (1975)

Table 8. (Continued)

Crops	Daylength Response	References
Tomato	A day-neutral plant.	Kassam (1976)
Winged bean	Requires short days for normal flower induction. Varieties differ in sensitivity to daylength. When planted during the season of long days (12-13 hours), most varieties develop considerable vine growth before flowering begins. It rarely flowers outside the tropics.	Martin and Delpin (1978) NAS (1975b)
Yam bean	Short days are necessary for tuber production. At a 14-15 hour photoperiod, vegetative growth is good but no tubers are produced	Kay (1973)
Yams (*Dioscorea* spp.)	Long days (greater than 12 hours) favor the growth of the vine. Short days (less than 10-11 hours) favor tuber development. Greater yam requires a daylength of less than 12 hours for tuberization.	Kassam (1976) Kay (1973)
Yardlong bean	Some cultivars are sensitive to daylength; others are day-neutral.	Kay (1979)

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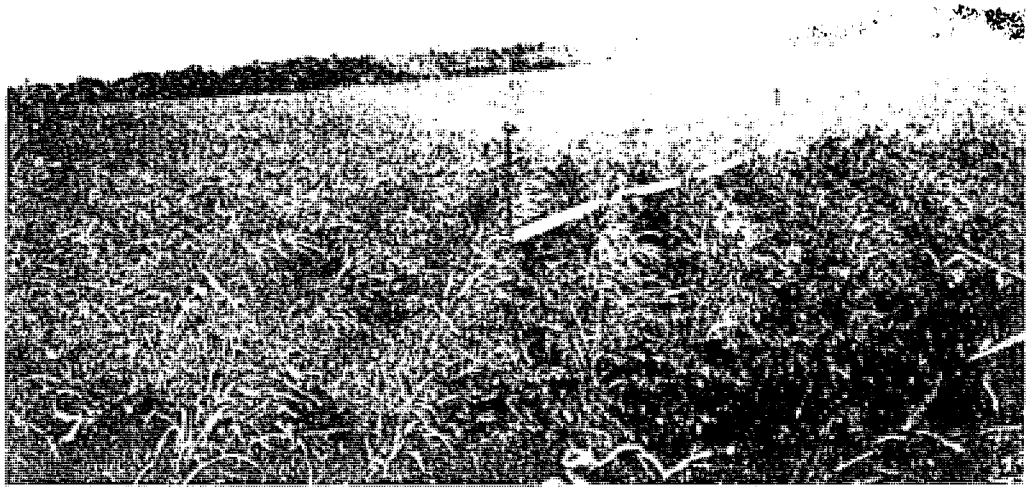

Water Supply

Water is the most important compound in an active plant cell. It forms 80-90% of the fresh weight of actively growing tissues and is very essential for plant growth.

Water status and growth have very complex relationship. It involves several physiological processes such as salt absorption and translocation, photosynthesis, and respiration. However, the process most directly and severely affected by water status of the plant is growth by expansion associated with the turgor of the cell

Reduction in soil moisture to about the permanent wilting percentage suppresses carbon dioxide absorption and, ultimately, photosynthesis. Suppression of photosynthesis prevents the accumulation of products necessary for growth. When water in the soil is limiting, the favorable effects of fertilizers are likewise suppressed. Fertilizer treatments in the solid form only become effective when the nutrients are dissolved in water. However, excessive rainfall or irrigation favors the loss of nutrients, inhibits aeration and nutrient uptake, and may even lead to the formation of substances toxic to the plant roots. Plants weakened by poor aeration are much more susceptible to diseases caused by soil-borne pathogens. Besides, application of too much water is wasteful.

Adequate moisture should be made available to the plant during the critical stage of growth or development, and before an adverse effect of water stress occurs on the physiological processes within the plant. The critical stage depends on the kind of crop and the purpose for which it is grown. For leafy vegetables, the critical period is during active vegetative growth. For root crops, it is during the formation and development of the storage organ or tuber. For crops grown for their fruits and/or seeds, the critical period is the reproductive stage. It does not mean, however, that water should be applied only during the critical period. This period is just a particular stage during the development of a crop when it is more sensitive to moisture conditions than in other stages of development.

Table 9 presents the water/rainfall requirements of various crops grown in the Philippines, their average growing period under local conditions, moisture-sensitive period, and reactions to drought and waterlogged conditions. The table could serve as guide to selecting suitable growing areas, timing, planting and irrigation operations, and determining the amount of water to apply for a particular crop.

The information presented in the table, particularly the water/rainfall requirement, was compiled from various sources, both local and foreign. As such, the data presented may not hold true under certain conditions since water requirement is location-specific and influenced by temperature, humidity, wind movement, and length of the growing period, among others. Modifications based on variety, soil characteristics, weather factors, management practices, and other field observations should be made, whenever necessary, to arrive at an optimum moisture regime.

Table 9. Water/rainfall requirements of crops grown in the Philippines

Crops	Water/Rainfall Requirements (mm/yr)[a]	Average Growing Period	Moisture Sensitive Period	Remarks	References
Abaca	1800-2900 (rainfall in the most productive abaca growing regions of the Philippines)	—	—	Rainfall should be uniformly distributed throughout the year. The most productive commercial abaca-growing provinces in the Philippines are found in the peripheral areas of Mindanao, Eastern Visayas, and the Bicol peninsula	Anunciado, *et al* (1977)
African oil palm	2000 or more	—	—	Most favorable areas are those with no prolonged dry periods. Where soils are reasonably retentive, the minimum annual rainfall can be around 1000 mm.	Godin and Spensley (1971)
Arrowroot	1500-2000	10-11 months	—	Sufficient water supply in the soil throughout the growing season is of primary importance. Optimum yields are obtained where rainfall is moderate and evenly distributed throughout the year, or where the dry season has very short duration.	Kay (1973) Mendiola (1958)
Avocado	750-1000 (min)[b]	—	—	West Indian varieties and their hybrids can thrive in tropical lowlands where annual rainfall may exceed 2500 mm. A climate with alternating wet and dry seasons is better than one with rains evenly distributed throughout the year.	Coronel (1978)

Table 9. (Continued)

Crops	Water/Rainfall Requirements (mm/yr)	Average Growing Period	Moisture Sensitive Period	Remarks	References
Banana	100-150 mm/month except in very porous soils	10-12 months	Throughout all growth stages, particularly during early growth stage, flowering, and fruit development	Serious shortage is experienced when there is less than 50 mm of rainfall in any month. AB, AAB, and ABB hybrids are better adapted to monsoon areas with marked dry season. AA and AAA varieties are produced mainly in areas where rainfall is equally distributed throughout the year, or where irrigation water is readily available.	Simmonds (1966) Doorenbos and Kassam (1979) Tai (1977)
Black pepper	1000-1500	—	—	Cannot withstand waterlogging so it is often grown in mounds. In the Philippines, black pepper thrives best in places where there are no distinct rainy and dry seasons.	Purseglove (1973) Anunciado (1969)
Cabbage	15-35 mm/week	65-110 days[b]	During head formation and enlargement	Requires moderately high soil moisture throughout its growth and adequate drainage of root zone.	Caoili and de Vera (1977) Doorenbos and Kassam (1979) Salter and Goode (1967)
Cacao	1500-2000[c]	—	Establishment period	When rainfall exceeds 2000 mm, yield is reduced due to waterlogging and/or high incidence of diseases. In places where rainfall is less than 1200 mm, cacao can only be grown successfully with irrigation, or where the ground water table is relatively high.	Alvim (1977) Salter and Goode (1967)

Carrot	15-35 mm/week[c]	40-60 days	—	Continuously high soil moisture results in undesirably short thick carrot with low carotene content and poor color. There seems to be no moisture-sensitive stages during growth and flowering.	Cacili and de Vera (1977) Boswell and Jones (1941) Salter and Goode (1967)
Cashew	1000-2000	—	—	Grows well in areas with rainfall varying from 500-3200 mm. Trees are drought resistant Cashew needs a climate with a well-defined dry season of 4 months or more to produce the best yields.	Nambiar, *et al.* (1980) Ohler (1979)
Cassava	500-2500 mm	8-12 months	—	Rainfall must be evenly distributed. Cassava can withstand periods of prolonged drought except at planting	Kay (1973)
Castor oil plant	600-1000 mm/crop	4-7[d]	Flowering, fruit set	Under dry conditions, annual castor plant requires 600 mm rain during the first 3 months of growth followed by a progressively drier period. It is very hardy and drought resistant.	Godin and Spensley (1971)
Cauliflower	15-35 mm/week[c]	60 days	Early seedling stage or just after planting; during rapid growth of curd	Requires plentiful supply of water throughout the development of the crop for maximum growth and yield.	Salter and Goode (1967)
Chico	1200-1800[c]	—	—	Performs best in areas with well-distributed rainfall. It is less attacked by pests and diseases in drier regions. Chico can be grown without difficulty	Coronel (1976)

Table 9. (Continued)

Crops	Water/Rainfall Requirements (mm/yr)	Average Growing Period	Moisture Sensitive Period	Remarks	References
				in areas with long dry seasons provided adequate water is supplied to the trees when young.	
Citrus	1000-2000	-	During flushes of new growth, flowering, fruit setting, and fruit enlargement	Lower rainfall value for cool, foggy, subtropical climate; higher values for hot, lowland tropical climate. In the tropics, high moisture stress probably limits growth more than temperature	Reuther (1977) Doorenbos and Kassam (1979) Mendoza and Valmayor (1976)
Coconut	1300-2300	—	—	The tree should never undergo severe moisture stress. Even distribution of rainfall probably is the most important factor influencing yield. Coconut roots do not tolerate waterlogging.	Murray (1977) Godin and Spensley (1971)
Coffee	1900 (for arabica) 1900-2500 (for robusta)	— —	— —	Rainfall should be well-spread over 9 months, leaving about 2-3 months with only 25-50 mm of rain to induce production of flower buds for the next season.	Haarer (1963) Wellman (1961)
Common bean	2.5 mm/week	Bush types: 75-95 days (for immature pods)[b] 45-50 days[e] 75-90 days (dry seeds)[b] Pole types: 80-100 days (for immature pods)[b] 50-65 days[e] 75-90 days (for seeds)[b]	Flowering and fruit development	Excessive or too little moisture may cause blossom and pod drop. Too dry soil needs irrigation before planting.	Meiners and Kraft (1977) Salter and Goode (1967)

Corn	610 mm/crop 6-8 mm/day during silking and soft dough stages	70-75 days (green corn) 95-110 days (grain corn)	Tasseling, silking, and grain filling	Reproductive processes and parts of corn are more sensitive to water stress than those of sorghum. Excessive moisture within the root zone for 36 hours will injure the plants.	Caoili and de Vera (1977) Mercado, *et al.* (1976) Doorenbos and Kassam (1979) Kassam (1976)
Cotton	700-1300 mm/crop	—	Start of flowering and during boll development	Requires adequate supply of water before flowering to ensure good growth conditions, and the production of plants large enough to support a satisfactory number of bolls.	Doorenbos and Kassam (1979) Salter and Goode (1967)
Cowpea	530 mm/crop or 35 mm/week	75-95 days (fresh pods)[b] 45-50 days[b, e] 75-90 days (for seeds)[b]	Flowering and pod filling	Drought and heat tolerant. Good drainage is necessary for efficient fixation of nitrogen by the nodule bacteria.	Caoili and de Vera (1977) Meiners and Kraft (1977)
Cucumber	300 mm/crop	100-110 days (for seeds)[b] 80-90 days (for fruits)[b] 45-50 days[b]	Flower formation and flowering, particularly at full bloom	Drought conditions during flowering and when the flowers are formed may result in deformed, nonviable pollen grains and may damage the gynoecium.	Caoili and de Vera (1977) Salter and Goode (1967)
Durian	2000 or more	—	—	Cultivated only in areas where the rainy season is long and well-distributed. It cannot tolerate more than 3 months of intense dry period. In areas with high water table, annual rainfall can be as low as 1500 mm provided it is evenly distributed. Roots are sensitive to standing water.	Malo and Martin (1979)

Table 9. (Continued)

Crops	Water/Rainfall Requirements (mm/yr)	Average Growing Period	Moisture Sensitive Period	Remarks	References
Eggplant	340-515 mm/crop 35-40 mm/week	95-150 days[b] 75-85 days[e]	—	Hardier than tomato since it can tolerate drought and more excessive rainfall.	Deanon (1967) Caoili and de Vera (1977) Bautista and Mabesa (1977)
Garlic	360-400 mm/crop	95-125 days	Bulb formation	Requires moderately wet soil from planting to the first signs of maturity. Mulching with rice straw is practiced in the Ilocos region to conserve soil moisture.	Caoili and de Vera (1977) Jones and Mann (1963)
Ginger	1500 or more	9-10 months	—	Requires humid climate. Irrigation is necessary if early growth stages coincide with the dry season.	Purseglove (1973) Mendiola (1958)
Grapes	—	—	Shoot elongation, flowering, and fruit development	Fairly resistant to drought conditions. Principal growing areas for wine grapes are characterized by relatively dry growing seasons.	Doorenbos and Kassam (1979) Magness and Traub (1941)
Greater yam	1000-1500 mm rainfall evenly distributed over 6-7 months	9-10 months	14th-20th week of growth	Requires long rainy season followed by a short dry season which usually corresponds to the time of short days and lower than normal temperature.	Kay (1973) Martin (1976) Kassam (1976)

				Drought reduces yield. Plants cannot tolerate excessive moisture.	
Jackfruit	—	—	—	Grows in all types of climate in the Philippines, but a warm wet climate is best.	Coronel (1977)
Lablab bean	600-1000	—	Early stages of growth	Drought tolerant, but needs good soil moisture to establish the crop.	Kay (1979) NAS (1979) Rachie and Roberts (1974)
Lanzones	—	—	Flowering season	Sensitive to poor drainage. It cannot withstand more than a few days of water saturation. It requires water in the soil throughout the year. Loss of crop has been associated with dry weather during the normal season of fruit maturation.	Almeyda and Martin (1977)
Lesser yam	875-1000 mm rainfall evenly distributed throughout the growing period	8-10 months	14th-20th week of growth	Requires long rainy season.	Martin (1974) Kay (1973) Kassam (1976)
Lettuce	300 mm/crop	35-70 days (leaf lettuce)[b] 60-85 days (head lettuce)[b]	Before harvesting	Continuously moist soil conditions are required throughout growth to obtain maximum yields.	Caoili and de Vera (1977) Villareal, *et al.* (1972) Salter and Goode (1967)
Lima bean	900-1500 mm/year or more	60-70 days[b] 85-100 days (dry seeds)[b] 100-200 days (fresh pods)[b]	Full bloom	Lack of moisture during early stages of growth reduces vegetative growth which results in low yield.	Kay (1979) Salter and Goode (1967)

Table 9. (Continued)

Crops	Water/Rainfall Requirements (mm/yr)	Average Growing Period	Moisture Sensitive Period	Remarks	References
Mango	760-3800	—	Young newly established trees during the first dry season, after blooming period, and during fruit development	Rainfall distribution is more important than quantity. Dry period before blossoming is conducive to profuse flowering. Cloudy and rainy weather at flowering adversely affects fruit setting. Heavy rains at ripening also cause considerable damage.	Gangolly, *et al.* (1957) Singh (1967) Coronel, *et al.* (1978)
Mangosteen	2500 or more	—	First few years of growth especially during the dry season	Grows in hot rainfall areas where, because of high humidity, few commercial crops can be economically cultivated. Have been grown successfully under dry conditions with irrigation. Water table about 2 m from the soil surface is ideal.	NAS (1975a) Almeyda and Martin (1976)
Mungbean	410 mm/crop 3.2 mm/day	60-68 days	Before and during flowering	Fairly drought tolerant. Growing season should not coincide with periods of heavy rainfall.	Caoili and de Vera (1977) Chiang and Hubbel (1978) Mendiola (1958) Quebral, *et al.* (1977)
Mustard	410 mm/crop	25-45 days (for leaves)[b] 100-110 days (for seeds)[b]	—	—	Caoili and de Vera (1977)
Okra	300 mm/crop	85-95 days[b] 50-60 days[b, d]	—	Grows well during both wet and dry seasons. Some varieties are sensitive to excessive soil moisture.	Caoili and de Vera (1977) Kassam (1976)

Onion	460 mm/crop	100-125 days	Any growth stage particularly during bulb development and flowering of seed crops	Requires adequate moisture during early growth and drier conditions towards maturity.	Caoili and de Vera (1977) Doorenbos and Kassam (1976) Salter and Goode (1967)
Papaya	1200 or more	—	Flowering	Very sensitive to even short periods of flooding. In dry areas, water is usually the main limiting factor for growth.	Pantastico, *et al.* (1977)
Pea	350-550 mm/crop	65-100 days (fresh pods) 85-120 days (dry seeds)	Flowering and pod swelling (filling)	Will not thrive on poorly drained soils.	Salter and Goode (1967) Doorenbos and Kassam (1979) Meiners and Kraft (1977)
Peanut	500-600 mm/crop 5-7 mm/day during peak of growth	90-150 days 90-110 days (recommended varieties in the Philippines)	Flowering and seed development	Requires moderate rainfall and does not tolerate water-logging. If soil moisture is adequate, higher yields are usually obtained during the dry season. Highly resistant to drought.	Rachie and Roberts (1974) Cagampang and Lantican (1975) Salter and Goode (1967) Kassam (1976) Quebral, *et al.* (1978)
Pechay	300 mm/crop	25-45 days (for leaves)[b] 100-110 days (for seeds)[b]	—	—	Caoili and de Vera (1977)
Pepper (sweet)	580 mm/crop	100-130 days[b] 75-90 days[b,d]	Throughout the growing period, particularly just before and at the start of flowering	A little hardier than tomato but probably more tender than egg-plant. It grows best in areas where rainfall is moderate or under dry conditions if irrigated. Cannot grow well if its roots are constantly flooded.	Deanon (1967) Martin, *et al.* (1979) Caoili and de Vera (1977) Doorenbos and Kassam (1979)

Table 9. (Continued)

Crops	Water/Rainfall Requirements (mm/yr)	Average Growing Period	Moisture Sensitive Period	Remarks	References
Pili	—	—	—	Requires moist humid climate with evenly distributed rainfall throughout the year. It has been grown successfully in places with distinct wet and dry seasons.	Coronel (1976)
Pigeon pea	over 500	90-250+ days[c]	—	Highly drought and heat resistant once established. High yields are obtained with good rainfall during the first 2 months of growth followed by a dry period at flowering and harvest.	Rachie and Roberts (1974) Kay (1979)
Pineapple	500-2540	17-24	Vegetative growth	May be grown under semi-arid conditions. It is reported to be nearly as hardy as cactus under drought conditions. In low rainfall areas, successful production requires good annual distribution of rainfall and water conserving management practices. The root system is very sensitive to water-logging. Optimum water/rainfall requirement is 1000-1500 mm/year.	Bartholomew and Kadzimin (1977) Doorenbos and Kassam (1979)
Potato	25 mm/week	90 days	From tuber initiation until the tubers are almost mature	Plentiful supply of water before tuber initiation increases the number of tubers and after this stage of growth, results in increase in tuber size. It needs	Salter and Goode (1967) Caoili and de Vera (1977) Kay (1973)

				no irrigation once it matures and the haulms start to turn yellow.	Balacing, *et al.* (1979)
Radish	300 mm/crop	30-100 days (for roots)[b] 100-110 days (for seeds)[b]	—	—	Cacili and de Vera (1977)
Rambutan	—	—	—	Very sensitive to water stress. It cannot withstand poor drainage conditions; much less capable to withstand poor drainage than mangosteen. Suitable to areas with high rainfall over a fairly long season.	Almeyda, *et al.* (1979)
Ramie	1125 or more	—	—	Requires evenly distributed rainfall. Irrigation may be needed during prolonged dry periods.	NAS (1975a)
Rice	1240 mm/crop	100-180 + days 105-140 days (recommended varieties in the Philippines)	Booting to flowering	Can be grown under upland conditions, moderately submerged conditions, and in 150-500 cm of water. Rice cultivation is limited to areas where annual rainfall exceeds 1000 mm.	Yoshida (1977) Obias (1967)
Rubber	1500-2000	—	—	A favorable rainfall distribution is more important than the absolute amount. It cannot withstand prolonged waterlogging.	Jacob and Uexkull (1960)
Sesame	—	90-120 days	—	Heavy rainfall and high humidity are harmful. A dry period for ripening is required. It cannot tolerate high concentrations of salt in the irrigation water. It can tolerate drought once established.	Godin and Spensley (1971) Kassam (1976)

Table 9. (Continued)

Crops	Water/Rainfall Requirements (mm/yr)	Average Growing Period	Moisture Sensitive Period	Remarks	References
Sorghum	450-650 mm/crop	100-140 days 100-115 days (recommended varieties in the Philippines)	Booting to heading	Has a marked degree of drought tolerance. It can tolerate periodic waterlogged conditions. Has the ability to stop growing during drought, remains uninjured, and then grows again when the drought is over.	Doorenbos and Kassam (1979) Kassam (1976) Fergus, *et al.* (1958) Salter and Goode (1967)
Soybean	530 mm/crop 3.2-3.3 mm/day	80-90 days 65-75 days (vegetable soybean)	Flower bud differentiation until the end of fruiting, particularly during flowering and fruit formation	Grows best in humid climate with plenty of rain during the growing season and more or less dry weather during ripening. It is less drought resistant than cowpea, but can endure more wet weather than corn, sugarcane, peanut, and cowpea.	Mendiola (1958) Caoili and de Vera (1977) Chiang and Hubbell (1978) Aycardo, *et al.* (1977) Salter and Goode (1967) Godin and Spensley (1971) Quebral, *et al.* (1976) Rachie and Roberts (1974)
Squash	460 mm/crop	100-130 days[d] 70-90 days[b,d]	— —	— —	Caoili and de Vera (1977)
Strawberry	—	—	Flower bud formation	A relatively shallow rooted crop and sensitive to insufficient moisture supply.	Magness and Traub (1941)
Sugarcane	1650 mm/crop	10-14	Tillering and stem elongation	Grows best when frequent heavy rainfall is interspersed with bright sunshine. Ripening	Halliday (1956) Caoili and de Vera (1977)

				and harvesting seasons require fairly dry, sunny, and cool climate.	Kassam (1976)
Sunflower	600-1000	90-130 days	Flowering and yield formation	Greater rainfall gives higher yields as long as there is a dry period during the later stage of ripening. Rainfall must be evenly distributed throughout the growing season.	Doorenbos and Kassam (1977) Godin and Spensley (1971)
Sweet potato	750-1000 460-500 mm/crop	90 120 days	50-60 days after planting	Can tolerate considerable periods of drought. Yields are reduced if water shortage occurs at the onset of tuber bulking. Moderately dry weather is favorable to formation and development of tuberous roots. Waterlogging should be avoided.	Kay (1973) Cadiz and Bautista (1967) Hahn (1977) Caoili and de Vera (1977)
Tannia	1400-2000	9-12	—	Land too wet for sweet potatoes and yams is well-suited. It grows in areas with annual rainfall as low as 1000 mm provided it is evenly distributed. More tolerant to lower rainfall conditions than taro. Some varieties also grow well on dry soils.	Kay (1973) NAS (1975a) Kassam (1976)
Taro	2500	6-18 7-12 (Philippines)	—	Adaptec to flooded environments. But it grows under a wide range of conditions ranging from paddy culture (like rice) to dry upland conditions under irrigation.	Kay (1973) NAS (1975a)
Tobacco	24 mm/week	90-120 days	Stage of very rapid growth (1½-2 months	Requires dry weather for ripening and harvesting. Exceptionally sensitive to very	Kassam (1976) Quimio, *et al.* (1979)

Table 9. (Continued)

Crops	Water/Rainfall Requirements (mm/yr)	Average Growing Period	Moisture Sensitive Period	Remarks	References
			after transplanting)	wet soil conditions. It is not usually grown where rainfall exceeds 1270 mm during the growing season.	Salter and Goode (1967)
Tomato	460 mm/crop	90-125 days[d] 70-80 days[b, d]	Start of fruit set onwards	Generally sensitive to wet soils but can tolerate drought conditions to some degree.	Deanon (1967) Caoili and de Vera (1977) Salter and Goode (1967)
Vanilla	2000-2500	—	—	Requires 2 dry months to check vegetative growth and allow vines to flower.	Purseglove (1973)
Watermelon	400-500 mm/crop	90-120 days[b] 70-80 days[b, d]	Vine development, flowering, and fruit development	More resistant to drought than muskmelon. It is not affected to some extent by high humidity. Better yields are obtained with adequate water supply until the fruits have almost reached maximum size. It requires dry conditions for ripening.	Doorenbos and Kassam (1979) Smith (1956) Tisbe, *et al.* (1967) Salter and Goode (1967)
Wax gourd	—	—	—	Relatively drought tolerant. It grows best in medium dry lowlands but not in high-rainfall areas.	NAS (1975a)
Wheat	450-650 mm/crop	100-130 days	Booting, flowering, and grain formation	Requires dry period for ripening. Irrigation is not necessary after the soft-dough stage.	Doorenbos and Kassam (1979) Salter and Goode (1967)

Winged bean	2500 or more	—	—	Does not survive prolonged drought. Fares best in the humid tropics, but it grows in dry tropics with irrigation.	NAS (1975a, 1975b)
Yam bean	—	5-6 (fleshy roots) 8 (tender pods) 10 (seeds)	--	Requires moderate rainfall. It can tolerate drought to some degree.	Cadiz and Bautista (1967) Kay (1973) NAS (1979)
Yardlong bean		bush types: 75-95 days (for fresh pods)[d] 45-50 days[b, d] 75-90 days (for seeds)[d] pole types: 85-115 days (for fresh pods)[d] 50-60 days[b, d] 75-100 days (for seeds)[d]	Flowering and pod filling	Requires and tolerates higher rainfall than cowpea. Highly drought resistant.	Rachie and Roberts (1974)

[a]Unless indicated otherwise
[b]Data supplied by H.B. Aycardo, UPLB, College, Laguna, Philippines
[c]Data supplied by P.S. Ongkingco, UPLB, College, Laguna, Philippines
[d]Days from sowing to harvesting of ripe seed
[e]Days from field setting to initial harvest

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Diseases

Plant diseases caused by bacteria, fungi, nematode, virus, viroids, and mycoplasma constitute one of the biological constraints in crop production. Under favorable conditions for development, diseases can cause tremendous losses in yield and reduction in quality. They also damage the crop both in the field and during storage. Disease organisms reduce plant growth and yield by producing toxins, interfering with the transport of water and nutrients, and reducing photosynthetic area and the efficiency of vital organs.

Knowledge of diseases attacking a crop, or occurring in a particular area, makes a grower aware of the potential constraints that have to be overcome. On the other hand, knowledge of the control measures and the host range of plant pathogens can help overcome these constraints.

This section presents the parasitic diseases of several crops, their causal organisms and control measures, as well as their host range in the Philippines. Symptoms, conditions favoring the disease, and other related information are not included since they are available in publications dealing with specific crops.

Table 10 lists the bacterial, fungal, nematode, viral, viroid, and mycoplasma

diseases of crops grown in the country, their causal organisms, and some recommended control measures.

Table 11 indicates the host range of different plant pathogens or plants attacked by the same disease-causing organisms. This table serves as guide in devising cropping patterns since it is often undesirable to plant in succession crops attacked by the same pathogen. Continuous cropping of the same piece of land with botanically related crops causes rapid build up of a number of disease-producing organisms which are very difficult or expensive to control. Bacterial wilt-infested fields, for example, should be placed on rotation using nonsusceptible crops such as cucumber, corn, rice, and soybean, among others.

Table 12 lists the fungicides recommended for controlling various fungal diseases to supplement the control measures presented in Table 10.

Table 10. Bacterial, fungal, nematode, and viral diseases of crops grown in the Philippines.

Crops	Diseases*	Causal Organisms*	Control Measures	References
Abaca	Bacterial disease			
	Wilt	*Pseudomonas solanacearum*	If disease is prevalent, well-trained inspectors should perform plant-to-plant inspection at 2- to 4-week intervals to detect the disease early and prevent its spread.	Benigno and Gavarra (1978)
	Fungal diseases			
	Anthracnose	*Gloeosporium musarum*	Select vigorous seedlings from the seedbed and grow them in rich soils.	Benigno and Gavarra (1978) Department of Agriculture (undated)
	Black spot or freckle	*Macrophoma musae*		
	Heart rot	*Fusarium moniliforme* var. *subglutinans*	Absence of bunchy top and root rot diseases and corm weevil will reduce incidence of the disease.	
	Leaf spot	*Helminthosporium torulosum*		
	Sheath rot	*Marasmius semiustus*	Avoid overcrowding to minimize high humidity.	
	Stem rot	*Helminthosporium torulosum*	Do not set the plants too close together.	
	Wilt	*Fusarium oxysporum* var. *cubense*	Plant resistant varieties: Inusa, Linawan, Tangongon.	
			Practice quarantine and exclusion measures.	
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		Davide and Eloja (1972)
	Root lesion or rot	*Pratylenchus* spp.		
	Root rot or decay	*Rotylenchulus reniformis*		
	Others	*Radopholus similis*		
		Helicotylenchus sp.		
		Xiphinema sp.		
		Hoplolaimus sp.		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Viral diseases			
	Bunchy top	Abaca bunchy-top virus	Rogue out infected areas once disease is spotted.	Benigno and Gavarra (1978)
	Mosaic	Cucumber mosaic virus or Sugarcane mosaic virus	Rogue out infected plants.	
			Grow a cover crop (*Centrosema plumieri*). Spray the abaca plants with insecticides.	
Avocado	Fungal diseases			
	Anthracnose	*Colletotrichum gloeosporioides*		
	Blight	*Rhizoctonia solani*		
	Die-back	*Colletotrichum gloeosporioides*		
	Fruit rot or blotch	*Cercospora purpurea*		
	Fruit rot	*Botryosphaeria ribis*		
		Rhizopus nigricans		
	Powdery mildew	*Oidium* sp.		
	Scab	*Sphaceloma perseae*		
	Seedling blight	*Pythium deharyanum*		
	Stem-end rot	*Diplodia natalensis*	Avoid wounding the fruits during harvesting or packing.	Quimio and Quimio (1974)
	Root rot	*Phytophthora cinnamomi*	In the orchard, avoid poorly drained and waterlogged conditions which would rapidly kill the roots.	Coronel (1978)
	Wilt	*Verticillium alboatrum*		
Banana	Bacterial diseases			
	Bugtok	Unidentified bacterium		
	Moko or wilt	*Pseudomonas solanacearum*		
	Tapurok	Unidentified bacterium		

Fungal diseases			
Anthracnose	*Colletotrichum musae* *Gloeosporium musarum*	Spray the fruits in the field as soon as fingers become exposed and before the rains begin.	Quimio and Quimio (1974)
Black diamond pit of fruit	*Cercospora* sp.		
Black leaf spot	*Helminthosporium torulosum*	Remove heavy leaf trash before the onset of heavy rain.	Quimio and Quimio (1975)
Black leaf streak	*Mycosphaerella fijiensis*	Postharvest dip in 200-400 ppm Nystatin.	
Black tip of fruit	*Helminthosporium torulosum*		
Brown rot of fruit	*Cercospora hayi*		Quimio and Quimio (1975)
Crown rot or fruit rot	*Botryodiplodia theobromae*		
Crown rot	*Fusarium roseum* *Thielaviopsis paradoxa* *Verticillium theobromae*		
End-rot of fruit	*Fusarium* sp.		
Finger tip rot	*Colletotrichum musae*		
Freckle	*Macrophoma musae*		
Fruit blast	*Diplodia crabra*		
Fruit brown rot or speckle	*Thielaviopsis paradoxa*		
Fruit rot	*Diplodia* sp.		
Heart leaf-rot	*Cercospora musae*		
Heart rot	*Fusarium* sp.		
Leaf spot or Sigatoka	*Cercospora musae*		
Leaf spot or Cordana	*Cordana musae*		
Pitting disease	*Piricularia grisea*	Remove transition leaves by cutting. Carefully remove the bracts. Protect the bunches with polyethylene bags.	Quimio and Quimio (1975)
Rust	*Uromyces musae*		
Scab	*Sphaceloma* sp.		
Stem rot	*Colletotrichum musae*		
Wilt	*Fusarium oxysporum* var. *cubense*		

Table 10. Bacterial, fungal, nematode, and viral diseases of crops grown in the Philippines

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		San Juan and Lozano (1978)
	Rot lesion and decay	*Pratylenchus coffeae*		Davide and Zarate (1974)
	Root rot or decay	*Rotylenchulus reniformis*		Davide and Gargantiel (1974)
	Topping down or black head rot	*Radopholus similis*		
	Others	*Helicotylenchus multicinctus*		Davide (1972)
		Rotylenchus spp.		
		Helicotylenchus spp.		
		Hopiolaimus spp.		
		Tylenchorhynchus spp.		
		Criconemoides spp.		
		Hemicriconemoides spp.		
	Viral diseases			
	Bunchy-top	Banana bunchy-top virus		
	Mosaic	Cucumber mosaic virus		
Beans	Bacterial diseases			
	Blight	*Xanthomonas phaseoli*		
	Wilt	*Pseudomonas solanacearum*		
	Fungal diseases			
	Angular leaf spot	*Isariopsis griseola*		
	Anthracnose	*Colletotrichum lindemuthianum*	Plant disease-free seeds. Practice crop rotation for 3 years or longer.	Quebral (1973)
			Burn infected plants or plow under to protect the succeeding crops, especially where crop rotation is not practiced.	Deanon, *et al.* (1975) Lapis and Panganiban (1966)

	Black pod spot	*Asteroma phaseoli*		
	Blight	*Rhizoctonia solani*		
	Damping-off	*Pythium debaryanum*		
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Leaf spot	*Cercospora canescens*		
	Pod rot	*Diplodia phaseolina*		
		Rhizoctonia solani		
	Powdery mildew	*Erysiphe* sp.		
	Root rot	*Fusarium solani*	Practice crop rotation with cereals.	Quebral (1973)
		Rhizoctonia solani	Avoid poorly drained soils.	Deanon, *et al.* (1975)
	Rust	*Uromyces appendiculatus*		
		Uromyces phaseoli var. *typica*		
	Seed rot	*Rhizoctonia solani*		
	Stem canker	*Rhizoctonia solani*		
	Stem rot	*Fusarium solani*		
		Sclerotium rolfsii		
	Tar spot	*Phyllachora phaseolina*		
	Nematode diseases			
	Root-knot	*Meloidogyne* spp.		
	Root lesion or rot	*Pratylenchus* spp.		
	Stubby roots	*Trichodorus* spp.		
	Viral diseases			
	Mosaic	Bean (common) mosaic virus		Talens (1977)
	Little leaf	Unidentified virus		
Bitter gourd	Bacterial disease			
	Wilt	*Pseudomonas solanacearum*	As soon as the disease occurs, remove or burn all diseased plants to eliminate the source of infection.	Manzanilla and Benigno (1966)
			Keep the field clean and free of weeds which may serve as host plants.	
	Fungal disease			
	Damping-off	***Sclerotium rolfsii***		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Nematode disease			
	Root-knot	*Meloidogyne arenaria* *M. thamesi* *M. incognita* *M. javanica*		
	Viral disease			
	Mosaic	Tobacco mosaic virus		
Black pepper	Fungal disease			
	Anthracnose	*Glomerella cingulata*		
	Nematode disease			
	Root-knot	*Meloidogyne incognita* *Rotylenchulus* spp. *Helicotylenchus* spp. *Hoplolaimus* spp *Tylenchorhynchus* spp.		Castillo (1973)
	Viral disease			
	Stunt	Pepper stunt virus		
Breadfruit	Fungal diseases			
	Fruit rot	*Rhizopus artocarpi*		
	Inflorescence rot	*Rhizopus artocarpi*		
	Leaf spot	*Cercospora artocarpi*		
	Rust	*Uredo artocarpi*		
Cabbage	Bacterial diseases			
	Black rot	*Xanthomonas campestris*	Make at least a 2-year rotation plan between crucifer crops both in the field and seedbed.	Deanon, *et al.* (1975)
	Head rot or soft rot	*Erwinia carotovora*	Do not set rows too close together and plants too crowded in a row, so that they will dry quickly.	Orillo, *et al.* (1959)
	Fungal diseases			
	Blackleg	*Phoma lingam*	Avoid overcrowding and over-watering.	Deanon, *et al.* (1975)

	Clubroot	*Plasmodiophora brassicae*		
	Damping-off	*Olpidium brassicae* *Pythium debaryanum* *Rhizoctonia solani* *Sclerotium rolfsii*	Water the seedbed only in the morning so that the soil will be dry at night. Ventilate to avoid excessive dampness. Sterilize the soil mixture for starting seedlings.	Orillo, *et al.* (1959)
	Downy mildew	*Peronospora parasitica*		
	Gray leaf spot	*Alternaria brassicae*		
	Head watery rot	*Sclerotinia libertiana*		
	Heart rot	*Rhizoctonia solani*	Avoid dirtying the cabbage leaves during cultivation. Avoid excessive watering and fertilization.	Quebral (1973) Deanon, *et al.* (1975)
	Leaf spot	*Cercospora brassicicola* *Phoma lingam*		
	Wilt or yellows	*Fusarium oxysporum* *F. conglutinans*		
	Nematode diseases			
	Root-knot	*Meloidogyne hapla* *M. javanica*		
	Root lesion or rot	*Pratylenchus* spp.		
	Stubby root	*Trichodorus* spp.		
	Stunt	*Tylenchorhynchus* spp.		
Cacao	Fungal diseases			
	Black rot	*Fusarium* sp. *Phytophthora palmivora*	Remove infected stems and fruits, and burn or treat them with fungicide. Reduce excessive humidity in the plantation by doing drainage and regular pruning of shade trees.	Bartolome (1960) Batal, *et al.* (1979)
	Brown rot of bark	*Hypomyces haematococcus*		
	Brown rot of pod	*Diplodia theobromae*		
	Canker	*Nectaria theobromae* *Phytophthora palmivora*		
	Charcoal rot of pod	*Botryodiplodia theobromae*		
	Dieback	*Diplodia theobromae*	Use Upper Amazon varieties and their crosses with Amelonado.	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
		Gloeosporium sp.		
	Dry sooty rot or storage rot	*Lasiodiplodia theobromae*		
	Pod blotch	*Nectaria bainii* var. *hypoleuca*		
	Pod rot	*Corticium salmonicolor*		
	Pink disease	*Phytophthora palmivora*		
	Red root disease	*Sphaerostilbe repens*		
	Seedling blight	*Phytophthora palmivora*		
	Thread blight	*Rhizoctonia solani*		
	Wilt	*Phytophthora palmivora*		
	Witches' broom	*Marasmius pernicious*	Select and plant resistant varieties or strains. Gather and burn all infected pods.	Bartolome (1960)
Carnation	Bacterial diseases			
	Leaf spot	*Pseudomonas woodsii*	In greenhouse, check the disease by providing adequate ventilation and keeping the foliage as dry as possible.	Pirone (1970)
	Wilt	*Pseudomonas caryophylli*	Avoid taking cuttings from plants having even the first sign of wilt. Destroy wilted plants by burning. Do not throw them into the compost pile. Dip cuttings in potassium permanganate solution before inserting them in the propagating bench.	
	Fungal diseases			
	Blight	*Alternaria dianthi*		
	Bud rot	*Fusarium poae*	Destroy all rotting buds.	Pirone (1970)

	Collar branch rot	*Alternaria dianthi*		
	Fairy ringspot	*Heterosporium echinulatum*		
	Gray mold rot	*Botrytis cinerea*		
	Leaf spot	*Septoria dianthi*	Keep the foliage as dry as possible.	
	Rust	*Uromyces caryophillinus*		
	Stem rot	*Corticum vagum*		
	Stem and root rot	*Sclerotium rolfsii*		
	Wilt	*Fusarium oxysporum* f. *dianthi*		
	Viral diseases			
	Mosaic	Unidentified virus		
	Streak	Unidentified virus		
	Yellows	Unidentified virus		
Carrot	Bacterial disease			
	Soft rot	*Erwinia carotovora*		
	Fungal diseases			
	Leaf blight	*Macrosporium carotea*		
	Stem rot	*Rhizoctonia solani*		
	Nematode disease			
	Root-knot	*Meloidogyne incognita*		
Cassava	Bacterial diseases			
	Soft rot	Unidentified bacterium		
	Bacterial blight	*Xanthomonas manihotis*	Use healthy planting materials.	Divinagracia (1980) Quimio and Daquioag (1975)
			Rogue infected plants as soon as they are observed.	
			Plant resistant varieties: Lakan-1 (UPL-Ca 2) and Datu 1 (UPL-Ca 1).	IPB (undated)
	Fungal diseases			
	Blight leaf spot	*Cercospora vicosae*	Plant resistant varieties: Lakan-1 (UPL-Ca 2) and Datu 1 (UPL-Ca 1).	Divinagracia (1980) IPB (undated)
	Leaf spot	*Cercospora manihotis*		
		Cercospora henningsii		
		Phyllosticta manihoticola		
	Storage rot	*Diplodia tubericicola*		
		Rhizopus nigricans		

Table 10. (Continued)

Crops	Diseases*	Causal Organisms*	Control Measures	References
	Wilt	*Sclerotium rolfsii*		
	White thread or fomes tuber rot	*Fomes lignosus*		Divinagracia (1980)
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		Castillo and Maranan (1974)
	Others	*Rotylenchus* sp. *Helicotylenchus* sp. *Hoplolaimus* sp. *Tylenchorhynchus* sp. *Ditylenchus* sp. *Aphelenchus* sp. *Pratylenchus* sp. *Criconemoides* sp. *Scutellonema* sp.		
	Viral diseases			
	Mosaic	Unidentified virus		
	Witches' broom	Unidentified virus or mycoplasma		
Cauliflower	Bacterial diseases			
	Black rot	*Xanthomonas campestris*		
	Soft rot	*Erwinia carotovora*		
	Fungal diseases			
	Blackleg	*Phoma lingam*		
	Clubroot	*Plasmodiophora brassicae*		
	Damping-off	*Pythium debaryanum* *Rhizoctonia solani* *Sclerotium rolfsii*		
	Downy mildew	*Peronospora parasitica*		
	Gray leaf spot	*Alternaria brassicae*		
	Leaf spot	*Carcospora brassicola*		
	White rust	*Albugo candida*		
	Yellow or wilt	*Fusarium oxysporum* f. *conglutinans*		

	Nematode disease			
	Root-knot	*Meloidogyne javanica* *M. incognita*		
Celery	Bacterial disease			
	Soft rot	*Erwinia carotovora*	Do not set rows too close together.	Orillo, *et al.* (1959)
	Fungal diseases			
	Damping-off	*Pythium debaryanum*	Sterilize the soil before sowing the seeds.	Orillo, *et al.* (1959)
			Ventilate to avoid excessive dampness.	
			Plant sufficient seeds in a seedbed.	
		Rhizoctonia solani *Sclerotium rolfsii*		
	Early blight	*Cercospora apii*	Prevent the disease by using a field where celery has not been grown for at least a year and by using clean seeds.	Orillo, *et al.* (1959)
	Late blight	*Seporia apii*		
	Leaf spot	*Cercospora apii*		
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		Castillo (1973) Castillo and Bulag (1974)
	Root lesion or rot	*Pratylenchus* spp. *Helicotylenchus* sp. *Trichodorus* sp.		
	Viral diseases			
	Dwarf	Unidentified virus		
	Mosaic	Unidentified virus		
	Yellows	Unidentified virus		
Chayote	Fungal disease			
	Leaf spot	*Cercospora* sp.		
	Nematode disease			
	Root-knot	*Meloidogyne incognita*		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
Chrysanthemum	Fungal diseases			
	Leaf and flower blight	*Botrytis* sp.		
	Leaf spot	*Cercospora chrysanthemi*	Avoid wetting the leaves while watering.	Pirone (1970)
			Avoid splashing soil into the lower leaves. Mulch with peat moss or other appropriate materials to prevent early infection.	
	Wilt	*Fusarium* sp.	If soil where plants have become diseased is to be used again, pasteurize it with heat or effective chemicals.	
			For complete control, use the indexing-of-cuttings method and grow the cuttings in pasteurized soil in raised benches, or in concrete-bottom ground-beds.	
Citrus	Bacterial diseases			
	Canker	*Xanthomonas citri*	Burn infected trees.	Mendoza and Valmayor (1976) Del Rosario (1968)
			Sterilize thoroughly all materials used.	
	Blast	*Pseudomonas syringae*		
	Black pit of fruit	*Pseudomonas syringae*	Observe proper cultural practices such as fertilization and irrigation.	
			Prevent untimely growth of leaves by scheduling planting.	
			Use windbreaks.	
			Prune diseased twigs.	
	Fungal diseases			
	Anthracnose	*Colletotrichum gloeosporioides*	Maintain the health and vitality of the trees by proper fertilization, cultivation, and orchard practices.	Mendoza and Valmayor (1976)

Bark rot	*Diplodia natalensis*	Provide good irrigation.	Mendoza and Valmayor (1976)
		Practice clean cultivation	Del Rosario (1968)
		Grow only vigorous trees.	
		Collect and destroy all infected parts.	
Black mold of fruit	*Rhizopus nigricans*		
Black spot of fruit	*Phoma citricarpa*	Pick all diseased and fallen fruits and remove them from the orchard.	Mendoza and Valmayor (1976)
			Del Rosario (1968)
Blue mold rot of fruit	*Penicillium italicum*	Handle fruits carefully to avoid injuries.	Mendoza and Valmayor (1976)
		Pick fruits when they are thoroughly dry.	
Brown rot of fruit	*Phytophthora citrophthora*	Gather and burn all fallen fruits.	
Damping-off	*Fusarium* spp.	Sterilize the soil for growing seedlings.	Mendoza and Valmayor (1976)
		Provide good drainage.	Del Rosario (1968)
		Acidify soils with any recommended sulfate.	
	Rhizoctonia solani		
	Sclerotium rolfsii		
Dry fruit rot	*Nematospora* sp.		
Dry root rot	*Fusarium* spp.		
Felt disease	*Septobasidium pseudopedicellatum*	Prune infected branches.	Mendoza and Valmayor (1976)
			Del Rosario (1968)
Fruit rot	*Diplodia natalensis*	Prune the trees. Remove infected materials from the orchard.	Mendoza and Valmayor (1976)
		Handle the fruits carefully to prevent injuries.	Del Rosario (1968)
		Burn rotten fruits to prevent spread of the spores.	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
		Fusarium spp. *Basiodiplodia theobromae* *Mucor* sp. *Rhizoctonia solani* *Sclerotium rolfsii*		
	Foot rot	*Phytophthora citrophthiora*	Use resistant rootstocks Troyer, Cleopatra Mandarin.	Mendoza and Valmayor (1976) Del Rosario (1968)
			Cut off the infected bark. Paint exposed portions of wood with asphalt paint or carbolineum after the edges start to heal.	
			Cut or thin the tops of severely infected trees.	
			Plant on well-drained land. Provide adequate drainage before planting. Avoid too close planting, too low budding, and too deep setting.	
			Do not allow soil around the base of trees to become too wet from irrigation. Do not scar the base of trunks during cultivation. Do not allow dirt, wood, weeds, or trash to accumulate on the base of trees.	
		Phytophthora parasitica *P. terrestria*		
	Green mold of fruit	*Penicillium digitatum*		
	Gummosis	*Diaporthe citri*	Paint the trunks with copper-zinc paste or carbolineum.	
			Avoid too deep planting of the tree. Keep the soil next to the trunk from becoming excessively wet. Avoid injuries in the bark.	

	Melanose	*Diaporthe citri*	Prune all dead twigs.	
	Pink disease	*Corticium salmonicolor*	Prune infected parts. Keep orchard clean from all sources of infections.	
	Phomopsis rot	*Phomopsis citri*		
	Powdery mildew	*Oidium tingitanium*		
	Root rot	*Fomes lamaoensis*		
	Scab	*Cladosporium* sp.		
	Sooty mold	*Capnodium citri*		
	Sour rot			
	Stem-end rot	*Diplodia natalensis*		
	Styler end-rot			
	Tip blight	*Phytophthora* sp.		
	Twig blight	*Fusarium solani*		
	Wither tip	*Colletotrichum gloeosporioides*		
	Mycoplasma disease			
	Greening or leaf mottle yellows			
	Nematode diseases			
	Root lesion or rot	*Pratylenchus* spp.		
	Slow decline	*Tylenchulus semipenetrans*		
	Viral diseases			
	Exocortis	*Citrus exocortis virus*		
	Psorosis	*Citrus psorosis virus*		
	Xyloporosis	*Citrus xyloporosis virus*		
Coconut	Bacterial diseases			
	Bud rot	Unidentified bacterium		San Juan and Rebigon (1977)
	Leaf blight	*Helminthosporium haloides*		
	Leaf stripe	Unidentified bacterium		
	Fungal diseases			
	Bud rot	*Phytophthora palmivora*	Cut and burn badly infected trees. Maintain field sanitation.	PCA (1976-77) Del Rosario (1967)
	Frond drop	*Thielaviopsis paradoxa*		
	Gray leaf spot	*Pestalozzia palmarum*		
	Immature nutfall	*Phytophthora palmivora*	Collect and burn infected nuts.	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
			Provide good drainage, proper care, and nutrition.	PCA (1976-77) Del Rosario (1967)
	Leaf blackening	*Capnodium footii*		
	Leaf spot	*Pestalozzia palmarum*	Apply fertilizers, e.g., muriate of potash and phosphate, to reduce severity of disease.	Abad and Magat (1977)
		Thielaviopsis paradoxa *Epicoccum cocos* *Exosporium durum* *Helminthosporium haloides* *H. incurvatum*		
	Root rot	*Thielaviopsis paradoxa*	Scoop out affected portions using sharp-edged tools. Treat wounds with copper fungicide or captan and paint them with coal tar. To prevent insect attack, apply alkyl pyridum halide directly as paste on wounds, then recoat with coal tar days later. Avoid unnecessary wounding of trees. Practice good farm management. Reduce the severity of diseases by proper soil management.	PCA (1976-77) Del Rosario (1967)
	Stem-bleeding	*Thielaviopsis paradoxa*		
	Wilt or crown rot	*Fusarium* sp.	Reduce the severity of diseases by proper soil management.	
	Viroid disease Cadang-cadang		Replant early-bearing palms or seedlings from survivor trees.	
	Nematodes	*Rotylenchulus* sp. *Helicotylenchus* sp. *Xiphinema* sp. *Meloidogyne* sp. *Tylenchorhynchus* sp.		Valdez, *et al.* (1975)

Coffee	Fungal diseases			
	Anthracnose	*Colletotrichum coffeanum*		
	Berry blight	*Colletotrichum coffeanum*		
	Berry blotch	*Cercospora coffeicola*		
	Black and white root rot	*Rosellina bunodes*		
	Brown root rot	*Fomes lamaoensis*		
	Damping-off	*Rhizoctonia solani*	Practice nursery sanitation.	Creencia, *et al.* (1976)
		Sclerotium rolfsii		
	Die-back	*Colletotrichum coffeanum*		
		Fusarium coffeicola		
		Phoma sp.		
	Iron spot	*Stilbella flavida*		
	Leaf spot	*Cercospora coffeicola*		
		Micropeltis mucosa		
	Pink diseases	*Corticium salmonicolor*		
	Root rot	*Armillaria mellea*		
		Fusarium sp.		
	Rust	*Hemeleia vastatrix*	Use resistant strains of Arabica coffee.	Ramos (1970)
	Sooty mold	*Aithaloderma longisetum*		
		Capnodium brasiliensis		
	Thread blight	*Pellicularia koleroga*	Prune infected trees. Burn diseased plant parts.	
			Regulate the amount of sunlight penetration and properly observe aeration by correct pruning practices.	
	Twig blight	*Coniothyrium coffeae*		
	Zonal leaf spot	*Cephalosporium* sp.		
	Mycoplasma disease			
	Witches' broom			
	Nematode diseases			
	Root-knot	*Meloidogyne* spp.		Valdez (1968)
	Root lesion or rot	*Pratylenchus* spp.		
	Stubby roots	*Rotylenchulus reniformis*		
	Viral disease			
	Ring spot	Unidentified virus		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
Corn	Bacterial diseases			
	Blight	*Bacterium stewarti*	Maintain field sanitation.	NFAC-UPLB (1970-71)
			Practice crop rotation.	UPLB (undated)
			Use native inbred lines.	Quebral and Exconde (1968)
	Leaf stripe	*Pseudomonas alboprecipitans*	Plant resistant varieties: UPCA Var. 1 and 2, MIT Selection, Kabacan Flint, Musuan Selection, Cebu White Flint, and Bukidnon White Flint.	
	Stalk rot	*Pseudomonas andropogoni* *Erwinia carotovora* var. *chrysanthemi* *Pseudomonas alboprecipitans*		
	Fungal diseases			
	Anthracnose	*Colletotrichum graminicolum*	Practice crop rotation. Maintain sanitation.	Quebral and Exconde (1968)
			Maintain a balance of phosphate and potash in the soil.	
	Bended sclerotial disease	*Rhizoctonia solani*		
	Black kernel rot	*Botryodiplodia theobromae*		
	Brown spot	*Physoderma maydis*	Use resistant varieties: Phil. DMR 1, MIT 2, Phil. DMR Composite 2.	
	Charcoal rot	*Macrophomina phaseoli*		
	Damping-off	*Rhizoctonia solani* *Sclerotium rolfsii*		
	Downy mildew	*Sclerospora philippinensis* *Sclerospora spontanes*	Maintain sanitation. Prune or destroy plants as soon as symptoms are observed.	Mercado, *et al.* (1976)

		Set early planting time, with a minimum period of about 2 weeks, to avoid heavy inoculum	
		Use resistant varieties: Phil. DMR 1 and 2, MIT Selection, Aroman 206, Aroman White.	
		Use moderately resistant varieties: Phil. DMR Opaque 2 Composite 1.	Aday (undated)
Dry ear rot	*Physelospora zeicola*		Aday (undated)
Ear rot	*Diplodia zeae*	Select healthy ears before harvesting.	
	Fusarium sp.		
	Rhizoctonia zeae		
Kernel blast	*Fusarium moniliforme*	Select thick, plump, bright, and clean kernels. Do not take seeds from a corn pile.	Quebral and Exconde (1968)
		Select healthy ears. Discard cracked and discolored kernels.	
		Use resistant varieties: Phil. DMR 2, MIT 2 and Phil. DMR Composite 1 and 2.	
Leaf blight	*Curvularia inaequalis*	Burn infected corn leaves right after harvest.	Quebral and Exconde (1968)
		Avoid close planting.	
		Practice crop rotation.	
		Use resistant varieties: Phil. DMR 02 Composite (Protena).	IPB (undated)
	Helminthosporium inconspicuum		
	Helminthosporium turcicum		
Leaf spot	*Curvularia* sp.	Use resistant varieties: Phil. DMR 1, Phil. DMR 2, Phil. DMR Composite 1 and 2, MIT 2.	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
		Diplodia macrospora *Helminthosporium maydis*		
	Pokkah-boeng Root rot	*Fusarium moniliforme* *Fusarium* spp.	Plant legumes instead of rice, sorghum, or sugarcane. Cultivate frequently to improve the soil condition. Maintain thorough drainage of the field and balanced fertility.	
		Phythium arrhenomanes var. *philippinensis* *Rhizoctonia solani*		
	Rust	*Puccinia polysora*	Use resistant varieties: UPCA Var. 1, Phil. DMR-02 Composite 1 (Protena), and BPI Var. 1.	
		Puccinia sorghi		
	Seed rot	*Fusarium* spp. *Pythium* spp.		
	Seedling blight	*Fusarium* spp. *Pythium* spp. *Rhizoctonia solani*		
	Smut	*Ustilago maydis*	Do not injure the plants when cultivating or spraying. In small plantings, remove and destroy galls before they rupture and release the spores.	
	Stalk rot	*Fusarium* spp.	Plant legumes instead of rice, sorghum, or sugarcane. Practice frequent cultivation to improve soil condition. Maintain thorough drainage of the field and balanced soil fertility.	

		Macrophomina phaseoli *Pythium* spp. *Sclerotium rolfsii*		
	Nematode diseases Stubby root Stunt	*Trichodorus* spp. *Tylenchorhynchus* spp. *Pratylenchus zeae* *Hoplolaimus coronatus* *Helicotylenchus* spp.		Walawala and Madamba (1970)
	Viral disease Mosaic	Maize dwarf mosaic virus Maize mosaic virus	Eradicate immediately all plants showing symptoms of the disease.	Quebral and Exconde (1968)
Cotton	Bacterial diseases Angular leaf spot Black arm Blight	*Xanthomonas malvacearum* *Xanthomonas malvacearum* *Xanthomonas malvacearum*	Apply seed protectant. Practice acid delinting. Plow under the crop residue or debris.	Bondad, *et al.* (1975)
	Wilt	*Pseudomonas solanacearum*		
	Fungal diseases Anthracnose	*Colletotrichum gossypii*	Destroy diseased plant residues. Observe seed treatment measures. Practice crop rotation. Plant resistant variety, e.g., Batac 1 (UPL-C1).	Bondad, *et al.* (1975)
	Areolate mildew	*Ramularia areola*		
	Blight	*Ascochyta gossypii*	Plant resistant variety, e.g., Batac 1 (UPL-C1).	IPB (undated)
	Boll rot	*Sclerotium rolfsii* *Alternaria* sp.		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
		Diplodia sp.		
		Fusarium moniliforme		
	Boll spot	*Helminthosporium gossypii*		
	Damping-off	*Pythium debaryanum*	Follow proper land preparation.	Bondad, *et al.* (1975)
			Bury the diseased crop residues from previous planting.	
			Observe seed treatment measures.	
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Dry root rot	*Fusarium moniliforme*		
		Schizophyllum commune		
	Flower blight	*Fusarium* sp.		
	Leaf blight	*Alternaria* sp.		
	Leaf spot	*Cercospora hibisci*		
		Helminthosporium gossypii		
	Lint stain	*Alternaria* sp.		
	Pink boll rot	*Colletotrichum gossypii*		
	Root rot	*Phymatotrich[illegible] omnivorum*	Practice deep plowing shortly after harvesting during dry periods. Bury crop residues.	
			Practice rotation with sorghum.	
			Apply high amounts of nitrogen.	
	Rust	*Kuehneola gossypii*		
	Seedling blight	*Colletotrichum gossypii*		
		Fusarium moniliforme		
		Helminthosporium gossypii		
	Soreshin	*Rhizoctonia solani*		
	Stem rot	*Fusarium moniliforme*		
		Sclerotium rolfsii		
	Wilt	*Verticillium alboatrum*	Practice rotation with corn and sorghum to reduce losses due to disease.	

			Minimize irrigation during seasons of abnormally low temperature.	
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		Benigno and Davide (1968)
	Others	*Rotylenchus reniformis*		Castillo and Sevilla (1978)
	Viral diseases			
	Interveinal yellowing	Unidentified virus		
	Leaf curl	Cotton leaf curl virus		
	Mosaic	Cotton mosaic virus		
Cowpea	Fungal diseases			
	Anthracnose	*Colletotrichum lindemuthianum*		
	Black leaf spot	*Cercospora* sp.		
	Blight	*Rhizoctonia solani*		
	Curly top	*Fusarium* sp.		
	Damping-off	*Pythium debaryanum*		
	Pod rot	*Phoma bakeriana*		
	Powdery mildew	*Erysiphe* sp.		
	Rust	*Uromyces phaseoli* var. *vigrae*		
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		Castillo (1974)
		Meloidogyne javanica		
	Root rot or decay	*Rotylenchulus reniformis*		
		Tylenchorhynchus sp.		
		Pratylenchus sp.		
	Viral diseases			
	Curly top	Unidentified virus		
	Green mosaic	Cowpea (aphid-borne) mosaic virus		
	Little leaf	Unidentified virus		
	Ring spot	Unidentified virus		
	Yellow mosaic	Bean (common) mosaic virus		
Cucumber	Bacterial diseases			
	Soft rot	*Erwinia carotovora*		
	Wilt	*Erwinia tracheiphila*		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Fungal diseases			
	Anthracnose	*Colletotrichum lagenarium*		Ilag (1974)
	Cottony leak	*Pythium aphanidermatum*		
	Damping-off	*Pythium deharyanum*		
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Downy mildew	*Pseudoperonospora cubensis*	Use black polyethylene plastic mulch to minimize infection from downy mildew and increase the number and quality of fruits.	Deanon (1966)
			Use resistant varieties: UPL-Cu 2 and UPL-Cu 1	
	Fruit rot	*Rhizoctonia solani*		
	Leaf spot	*Cercospora* sp.		
	Powdery mildew	*Erysiphe cichoracearum*	Use resistant varieties: UPL-Cu 2 and UPL-Cu 1.	
	Root rot	*Pythium deharyanum*		
		Rhizoctonia solani		
	Wilt	*Fusarium oxysporum*		
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		
	Stunt	*Tylenchorhynchus* spp.		
	Viral disease			
	Mosaic	Cucumber mosaic virus	Keep areas free from weeds. Follow good sanitation practices.	Quebral (1973)
			Use varieties which are tolerant to mosaic: Tablegreen, Zamboanga, and Gemini.	
		Watermelon mosaic virus		
Durian	Fungal diseases			
	Bark disease	*Trametes personii*		
	Fruit rot	*Diplodia duriones*		
	Leaf spot	*Placosphaeria durionis*		

Eggplant	Bacterial diseases			
	Soft rot	*Erwinia carotovora*		
	Wilt	*Pseudomonas solanacearum*	Use resistant varieties: Long Light Purple and Dingras Multiple Purple No. 1.	Anonymous (1975) Deanon, *et al.* (1975)
	Fungal diseases			
	Anthracnose	*Colletotrichum melongena*	Remove and burn all diseased fruits and leaves.	Orillo, *et al.* (1959)
	Blight	*Phomopsis vexans*		
		Sclerotium rolfsii		
	Cottony leak	*Pythium aphanidermatus*		Ilag (1974)
	Damping-off	*Phomopsis vexans*	Remove and burn immediately infected seedlings including the soil.	Orillo, *et al.* (1959)
			Sterilize the soil before sowing the seeds.	
		Pythium debaryanum		
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Fruit rot	*Colletotrichum melongena*	Collect and burn infected fruits.	Deanon, *et al.* (1959)
		Diplodia degenerans	Set the plants farther apart in the field.	
		Phomopsis vexans		
		Phyllosticta hortorum		
		Phytophthora melongena		
		Phytophthora parasitica		
		Rhizoctonia solani		
	Leaf mold	*Cladosporium fulvum*		
	Leaf spot	*Cercospora melongena*		
		Colletotrichum melongena		
		Phomopsis vexans		
		Phyllosticta hortorum		
		Rhizoctonia solani		
		Septoria lycopersici		
	Rust	*Puccinia tubulosa*		
	Stem rot	*Sclerotium rolfsii*		
	Tip over	*Phomopsis vexans*		
	Wilt	*Sclerotium rolfsii*		
		Fusarium oxysporum		

Table 10. (Continued)

Crops	Diseases*	Causal Organisms*	Control Measures	References
	Nematode diseases			
	Root-knot	*Meloidogyne hapla*		Castillo (1973)
		Meloidogyne incognita		
	Root lesion or rot	*Pratylenchus* spp.		
	Stunt	*Tylenchorhynchus* spp.		
	Others	*Helicotylenchus* spp.		
		Rotylenchulus spp.		
Garlic	Bacterial disease			
	Soft rot	*Erwinia carotovora*		
	Fungal diseases			
	Bulb rot	*Fusarium oxysporum* f. *cepae*		
	Downy mildew	*Peronospora destructor*		
	Leaf spot	*Cercospora duddiae*		
	Pink root	*Phoma tenastris*		
	Purple blotch	*Alternaria porri*		
	Smut	*Urocystis cepulae*		
	White rot of bulb	*Sclerotium cepivorum*		
	Nematode diseases			
	Bloat	*Ditylenchus dipsaci*		
	Root-knot	*Meloidogyne javanica*		
	Root lesion or rot	*Pratylenchus* spp.		
	Stunt	*Tylenchorhynchus* spp.		
Ginger	Bacterial diseases			
	Rhizome rot	*Xanthomonas zingiberi*		
	Wilt	*Pseudomonas solanacearum*		
	Fungal diseases			
	Black rhizome rot		To control black rhizome rot and leaf spots:	
		Rosellinia zingiberi	Do not stock, pile, or store healthy rhizomes along with shrivelled and discolored ones.	Mailum and Divinagracia (1969)

			Never use discolored and shrivelled rhizomes for planting. Disinfect seed pieces. Avoid close and thick planting. Practice crop rotation.	
	Leaf spot	*Coniothyrium zingiberi* *Phyllosticta zingiberi*		
	Nematode disease Root-knot	*Meloidogyne arenaria* *Meloidogyne incognita*		
Grapes	Bacterial disease Crown gall	*Agrobacterium tumefaciens*		Quimio and Quimio (1974)
	Fungal diseases Anthracnose	*Elsinoe ampelina* *Colletotrichum gloeosporioides*		
	Bird's eye rot	*Elsinoe ampelina*		
	Black rot	*Guignardia bidwelli*		
	Branch necrosis or dead arm	*Cryptosporella viticola*		
	Downy mildew	*Plasmopara viticola*		
	Leaf spot	*Cercospora viticola*		
	Powdery mildew	*Uncinula necator*		
	Rust	*Physopella vitis*		
	Botryodiplodia rot of grapes	*Botryodiplodia theobromae*		Lantican and Quimio (1976)
	Nematode diseases Root-knot	*Meloidogyne arenaria* *Meloidogyne incognita*		Davide, *et al.* (1979)
	Others	*Rotylenchus reniformis* *Tylenchulus semipenetrans*		
	Viral diseases Fan leaf	Grapevine fan leaf virus		
	Interveinal chlorosis	Unidentified virus		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
Guava	Fungal diseases			
	Anthracnose	*Gloeosporium psidii* *Colletotrichum gloeosporioides*		
	Canker	*Gloeosporium psidii*		
Guayabano	Fungal disease			
	Leaf spot	*Phyllosticta insulacum*		
Hyacinth bean	Fungal diseases			
	Leaf spot	*Cercospora* sp.		
	Leaf disease	*Septoria lablabina*		
	Orange gall	*Woroninella dolochi*		
	Stem diseases	*Diplodia loblab*		
	Nematode disease			
	Root-knot	*Meloidogyne javanica*		
Jackfruit	Fungal diseases			
	Fruit decay	*Diplodia* sp.		
	Fruit rot	*Rhizopus artocarpi*		
	Inflorescence rot	*Rhizopus artocarpi*		
	Leaf spot	*Cercospora artocarpi*		
	Pink disease	*Corticum salmonicolor*		
	Soft rot	*Rhizopus nigricans*		
	Stem rot	*Sclerotium rolfsii*		
Jute	Fungal diseases			
	Black band or stem rot	*Macrophoma corchori*		
	Damping-off	*Rhizoctonia solani*		
	Stem rot	*Macrophoma phaseoli*		
	Nematode disease			
	Root-knot	*Meloidogyne incognita* *Meloidogyne javanica*		
Kenaf	Fungal diseases			
	Blight	*Phoma sabdariffae*	Practice 2-3 year crop rotation since the fungus can live on decaying	Quiniones and Orillo (1952)

			plant remains for 3-6 months or longer. Never plant roselle before or after kenaf. Gather and burn all infected plant remains.	
	Damping-off	*Pythium debaryanum* *Sclerotium rolfsii*		
	Foot rot	*Rhizoctonia solani* *Sclerotium rolfsii*		
	Leaf spot	*Cercospora hibisci*		
	Wilt	*Verticillium alboatrum*		
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		
	Root lesion or rot	*Pratylenchus* spp.		
Lanzones	Fungal disease			
	Root rot or wilt	Unidentified fungus	Dig up dead trees and burn all parts. Treat infected roots with lime-sulfur solution immediately. Avoid overcrowding trees either among themselves or with other trees. The trees should be spaced 7 m x 7 m apart. Provide adequate drainage during rainy days since the root rot organism prefers waterlogged soil.	Coronel (1977) Chanliongco (1965)
	Nematode disease			
	Root-knot	*Meloidogyne incognita*		
Lettuce	Bacterial disease			
	Soft rot	*Erwinia carotovora*		
	Fungal diseases			
	Blight	*Sclerotium rolfsii*		
	Damping-off	*Fusarium* sp.	Sterilize the seedbed for starting seedlings.	Crillo, *et al.* (1959)

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
			Plant only sufficient seeds in a seedbed.	
			Provide adequate ventilation to avoid excessive dampness.	
		Pythium aphanidermatum		
		Pythium debaryanum		
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Downy mildew	*Bremia lactucae*		
	Leaf spot	*Alternaria brassicae*		
		Cercospora lactucae		
	Stem rot	*Sclerotium rolfsii*		
	Nematode diseases			
	Root-knot	*Meloidogyne thamesi*		
		Meloidogyne javanica		
	Root lesion or rot	*Pratylenchus* spp.		
	Stunt	*Tylenchorhynchus* spp.		
Lima bean	Bacterial disease			
	Blight	*Pseudomonas phaseoli*		
	Fungal diseases			
	Anthracnose	*Colletotrichum lindemuthianum*		
	Blight	*Rhizoctonia solani*		
	Damping-off	*Pythium debaryanum*		
		Rhizoctonia solani		
	Downy mildew	*Phytophthora phaseoli*		
	Leaf spot	*Cercospora lussoniensis*		
	Rot	*Diplodia phaseolina*		
	Spotting of pods and seeds	*Cladosporium herbarum*		
	Nematode diseases			
	Root-knot	*Meloidogyne* spp		Castillo (1973, 1974)
	Others	*Rotylenchulus* spp.		

		Tylenchorhynchus spp. *Hoplolaimus* spp.		
Maguey	Fungal diseases Anthracnose Leaf spot	 *Colletotrichum agaves* *Diplodia agaves*		
Mango	Bacterial disease Leaf spot	 *Bacillus mangifera*		
	Fungal diseases Anthracnose	 *Colletotrichum gloeosporioides*	During off-season, do flowering induction after 1-2 dry months to avoid the disease.	Custodio, *et al.* (1975)
	Angular leaf spot Black mildew Die-back Fruit rot	*Leptothyrium circumscissum* *Meliola mangiferae* *Diplodia natalensis* *Aspergillus niger*	Handle the fruits carefuliy to avoid bruises which are avenues of infection.	Quimio and Quimio (1974) Castillo *et al.* (1975)
	Leaf blight Leaf spot	*Pestalozzia mangiferae* *Thielaviopsis paradoxa* *Pestalozzia pauciseta* *Cercospora mangiferae* *Pestalozzia funerae* *Pestalozzia mangiferae*		
	Mistletoe	*Phyllachora* sp. *Loranthus philippinensis*	Pluck the mistletoe plants as they appear to reduce the effect of parasites. Eradicate the parasite by cutting the affected branch several inches below the mistletoe.	
	Pink disease	*Corticium salmonicolor*	Burn all prunings. When the disease persists in the plantation, prune the less important branches for better aeration. This will lower the relative humidity which is conducive for disease development.	Bergonia, *et al.* (1975)

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Scab	*Elsinoe mangiferae*		
	Seed rot	*Rhizoctonia solani*		
		Sclerotium delphiniae		
	Seedling blight	*Phytophthora* sp.		
	Sooty mold	*Capnodium mangiferum*	Check the appearance of the disease by destroying the insects that excrete the "honey dew."	Bergonia, *et al.* (1975)
	Stem-end rot	*Diplodia natalensis*	Avoid using banana leaves as cushion since they are infected with a similar fungus infecting the fruits. Use of old newspapers is recommended.	
	Twig blight	*Diplodia natalensis*		
Mulberry	Fungal diseases			
	Leaf spot	*Cercospora* sp.		
	Powdery mildew	*Phyllactinia suffulta*		
	Rust	*Kuehneola fici* var. *moricola*		
Mungbean	Fungal diseases			
	Anthracnose	*Colletotrichum lindemuthianum*	Do not sow infected seeds, or seeds from infected pods.	Barredo (1977) Ilag, *et al.* (1979) Soria and Quebral (1973) Quebral (1974)
	Blight	*Rhizoctonia solani*		
	Leaf spot	*Cercospora cruenta*	Plant resistant varieties: CES 1D-21 (Pagasa) and UPL-Pn 4 (Biyaya).	
	Powdery mildew	*Erysiphe polygoni*	Plant mungbean when its vegetative growth will not coincide with the environmental conditions most favorable for occurrence and development of powdery mildew.	
			Plant resistant varieties: CES 1D-21 (Pagasa) and CES 2F-1 (Pagasa #2).	

	Rust	*Uromyces appendiculatus*		Catedral and Halos (1977)
	Stem-end rot	*Rhizoctonia solani*		
	Stem rot	*Fusarium solani* f. sp. *phaseoli*		
	Nematode diseases			
	Root-knot	*Meloidogyne javanica*	Practice crop rotation using 1 or 2 croppings of resistant cereals (rice and corn) preceding the mungbean crop during each cropping year.	Castillo and Litsinger (1977)
			Control the nematode population by flooding, especially in a rice-field legumes-vegetables cropping pattern.	
	Root lesion or rot	*Pratylenchus reniformis*		
	Root lesion or decay	*Rotylenchulus* sp.		
	Viral diseases			
	Mosaic	Bean common mosaic virus		
		Yellow mosaic virus (YMV)		
		Green mosaic virus		
	Mottle	Blackgram mottle virus		Talens (1979)
	Little leaf disease	Unidentified virus		
	Leaf curl browning	Unidentified virus		
	Witches' broom	Mycoplasmalike organism		Benigno (1979)
Muskmelon	Fungal diseases			
	Anthracnose	*Colletotrichum lagenarium*		
	Downy mildew	*Pseudoperonospora cubensis*		
	Powdery mildew	*Erysiphe cichoracearum*	Use tolerant varieties: Imperial 45 and Honey dew.	Deanon, *et al.* (1975) Quebral (1973)
	Fruit rot	*Fusarium roseum*		
		Fusarium solani		
		Phytophthora parasitica	To reduce losses, sort carefully and discard infected fruits before storage and transport.	Quimio and Quimio (1974)
		Fusarium moniliforme var. *subglutinans*		
	Scab	*Cladosporium cucumerinum*	Dip the fruits in 2.5% borax solution at 43°C for 30 seconds to control postharvest development of the disease.	Quimio and Quimio (1974)

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Stem-end rot	*Fusarium moniliforme* var. *subglutinans* *Fusarium roseum* *Fusarium solani* *Physalospora rhodina*		
	Wilt	*Fusarium oxysporum*		
	Nematode disease			
	Root-knot	*Meloidogyne incognita* *Meloidogyne javanica*		
	Viral disease			
	Mosaic	Watermelon mosaic virus Cucumber mosaic virus Unidentified virus		
Okra	Fungal diseases			
	Damping-off	*Pythium debaryanum*		
	Leaf mold	*Cercospora abelmoschi*		
	Leaf spot	*Cercospora hibisci*		
	Nematode diseases			
	Root-knot	*Meloidogyne arenaria* *Meloidogyne javanica*		
	Root lesion or rot	*Pratylenchus* spp.		
	Stunt	*Tylenchorhynchus* spp.		
Onion	Bacterial disease			
	Soft rot	*Bacillus subtilis* *Erwinia carotovora* *Pseudomonas aliicola* *Pseudomonas cepacia* *Xanthomonas capsici*		
	Fungal diseases			
	Black mold	*Aspergillus niger*		
	Black stalk rot	*Macrosporium parasiticum*		

	Blight	*Sclerotium rolfsii*	Practice crop rotation. Maintain sanitation.	Quebral (1973)
	Bulb rot	*Fusarium oxysporum*		
		Fusarium sonatum		
	Damping-off	*Sclerotium cepivorum*		
	Downy mildew	*Peronospora destructor*		
	Gray mold	*Botrytis allii*		
	Leaf spot	*Cercospora duddiae*		
	Neck rot	*Botrytis allii*		
	Pink rot	*Phoma tenastris*		
	Purple blotch	*Alternaria porri*	Practice crop rotation. Destroy dead foliage and rotten bulbs.	Quebral (1973)
	Root rot	*Fusarium oxysporium*		
	Rust	*Puccinia porri*		
	Smudge	*Colletotrichum circinans*		
	Smut	*Urocystis cepulae*		
	Soft rot	*Rhizopus nigricans*		
	White bulb rot	*Sclerotium cepivorum*		
Orchids (Include the following genera: ***Cattleya, Cymbidium, Dendrobium, Grandiflora, Phalaenopsis, Spathoglottis, Vanda***)	Bacterial diseases			
	Brown rot	*Pseudomonas cattleyae*	Avoid injuring the plants. Do not expose them to prolonged wetness.	Valmayor, *et al.* (1977)
	Soft rot	*Erwinia carotovora*	Control insects and small animals that bite or cause wounds.	
			Provide proper ventilation in the greenhouse.	
			Provide plastic roof, especially for Phalaenopsis, to shield plants from too much rain.	
	Phalaenopsis rot	Unidentified bacteria		
	Fungal diseases			
	Anthracnose	*Colletotrichum gloeosporioides*	Avoid sunscalding and injuring the plants.	Valmayor, *et al.* (1977)
			Remove infected leaves.	
	Sclerotium or basal rot	*Sclerotium rolfsii*	Remove infected, dying plants carefully and burn them.	Valmayor, *et al.* (1977)

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
			Isolate infected plants from healthy ones. Avoid splashing the soil to nearby plants when watering.	
			Use sterile soil if possible.	
			Control insects and crawling soil animals.	
	Black rot	*Phytophthora palmivora*	Practice sanitation and quarantine.	Valmayor, *et al.* (1977)
			Control insects, snails, and other small animals since they may carry the fungus.	
			Avoid dampness, especially prolonged ones.	
			Avoid wounds.	
	Yellow spot	Unknown		Divinagracia (1979)
	Floral stalk rot	Unknown		
	Basal root rot	Unknown		
	Nematode disease Yellow bud blight	*Aphelencoides besseyi*		
	Viral disease Mosaic	*Cymbidium* mosaic virus	Dip knives and pruning shears in a solution of trisodium orthophosphate to kill any sap-transmissible virus adhering to the surfaces.	Pirone (1970)
		Tobacco mosaic virus — Orchid strain		
Ornamentals				
	Fungal diseases Anthracnose of anthurium	*Gloeosporium* sp.	Avoid wetting the foliage when watering.	Pirone (1970)

	Colletotrichum sp.	Remove and destroy badly infected leaves or parts of leaves.	
Anthracnose of sampaguita	*Colletotrichum* sp.		
Anthracnose of milflores	*Colletotrichum* sp.		
Powdery mildew of milflores	*Oidium* sp.		
Leaf spot of mussaenda	*Cercospora* sp.		
Leaf spot of gumamela	*Cercospora* sp.		
Leaf spot of gladiolus	*Curvularia lunata* *Penicillium gladioli*	Avoid wounding the corms. Store corms in a cool dry place at 2-7°C to prevent initial infection. Practice prompt curing or drying of corm. Cure freshly harvested corms at about 29°C for 10-15 days.	Pirone (1970)
Corm rot of gladiolus	*Fusarium oxysporum* f. *gladioli*		
Rust of gladiolus	*Uromyces* sp.		
Rust of yellow day lily	*Puccinia* sp.		
Sclerotium rot of Saint Paulia	*Sclerotium* sp.		
Bacterial diseases			
Soft rot of Kalanchoe	Probably: *Erwinia carotovora*		
Blight of gladiolus	Unknown bacteria	**Plant healthy corms in a new area.**	Pirone (1970)
Viral diseases			
Mosaic of dahlia	Unidentified virus		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Yellow ringspot Mosaic of sampaguita	Unidentified virus		Benigno, *et al.* (1975)
	Nematode diseases			
	Root-knot of dahlia	*Meloidogyne incognita*		
	Wilt of Saint Paulia	Unknown nematode		
Papaya	Bacterial disease			
	Soft rot	*Erwinia caricae*		
	Fungal diseases			
	Anthracnose	*Colletotrichum gloeosporioides*	Store papaya at 10°C to delay ripening and inhibit anthracnose development.	Quimio (1973)
	Blight	*Phytophthora parasitica*	Remove and destroy immediately infected plants and fruits from the orchard	Cuevas and Espino (1975)
			Good drainage conditions reduce infection.	
	Damping-off	*Pythium debaryanum*	Sterilize soil in the seedbed at 80-85°C for 30 minutes.	Pantastico, *et al.* (1977)
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Fruit rot	*Cercospora papayae*		
		Colletotrichum gloeosporioides		
		Colletotrichum papayae		
		Fusarium solani		
		Lasipidiplodia theobromae		Quimio and Quimio (1974-75)
		Penicillium sp.		
		Phytophthora palmivora	Remove infected plants and fruits immediately from the field and dispose them properly.	Pantastico, *et al.* (1977)
		Phytophthora parasitica		
		Rhizopus nigricans		

		Botryodiplodia theobromae		
		Rhizopus stoloniter		
	Leaf spot	*Helminthosporium papayae*		
	Powdery mildew	*Erysiphe* sp.		
	Target spot	*Mycosphaerella caricae*		
	Wilt or root rot	*Phytophthora palmivora*		
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		
	Root rot or decay	*Rotylenchulus reniformis*		
		Helicotylenchus sp.		
		Pratylenchus sp.		
	Viral diseases			
	Leaf curl	Papaya leaf curl virus	Remove diseased plants while incidence of the disease is still low.	Pantastico, *et al.* (1977)
			Avoid planting cucurbits near papaya plants.	Cuevas and Espino (1976)
	Mosaic	Papaya mosaic virus		
Pea	Fungal diseases			
	Blight	*Ascochyta pinodes*		
	Damping-off	*Pythium debaryanum*		
		Sclerotium rolfsii		
	Foot rot	*Ascochyta pinodes*		
	Powdery mildew	*Erysiphe polygoni*		
		Peronoplasmopara sp.		
	Root rot	*Rhizoctonia solani*		
	Stem canker	*Rhizoctonia solani*		
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		
	Root rot	*Pratylenchus* spp		
Peanut	Bacterial disease			
	Wilt	*Pseudomonas solanacearum*		
	Fungal diseases			
	Black leaf spot	*Cercospora personata*	Observe proper spacing of plants.	Raymundo and Lapis (1962)
			Plant resistant varieties such as FBI-9 (EG Red x Fants 17).	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Blight	*Rhizoctonia solani*		
	Damping-off	*Sclerotium rolfsii*		
	Leaf spot	*Septogloeum arachidis*		
	Pod rot	*Sclerotium rolfsii*		
	Root rot	*Sclerotium rolfsii*		
	Rust	*Puccinia arachidis*		
	Stem rot	*Sclerotium rolfsii*	Plow deep to bury the surface debris.	Quebral (1974)
			Avoid thinning of soil around the base of the plant during cultivation.	Barredo (1977) Ilag, *et al.* 1979)
	Wilt	*Sclerotium rolfsii*		
	Nematode diseases			
	Root rot or decay	*Rotylenchulus reniformis*		Davide (1975)
	Stunt	*Tylenchorhynchus* spp.		
	Others	*Aphelenchus* sp.		
		Helicotylenchus sp.		
	Viral diseases			
	Mottle	Peanut mottle virus	Avoid planting seeds from infected plants since the virus is seed-borne.	Ilag, *et al.* (1979)
	Ring spot	Unidentified virus		
	Rosette	Peanut rosette virus		
Pechay	Bacterial diseases			
	Black rot	*Xanthomonas campestris*		
	Soft rot	*Erwinia carotovora*		
	Fungal diseases			
	Black leg	*Phoma lingam*		
	Clubroot	*Plasmodiophora brassicae*		
	Damping-off	*Fusarium* spp.		
		Pythium debaryanum		
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Downy mildew	*Peronospora parasitica*		
	Gray leaf spot	*Alternaria brassicae*		

	Heart rot	*Pythium aphanidermatum*		
	Leaf spot	*Alternaria herculea*		
		Cercospora armoraciae		
		Cercospora brassicicola		
	White rust	*Albugo candida*		
	Wilt or yellows	*Fusarium oxysporum* f. *conglutinans*		
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*	Apply chicken manure or rice straw compost at 5 kg/2 m^2.	Quistado (1970)
	Root lesion or rot	*Pratylenchus* spp.		
	Stubby root	*Trichodorus* spp		
	Viral disease			
	Mosaic	Unidentified virus		
Pepper	Bacterial diseases			
	Blight	*Xanthomonas vesicatoria*		
	Fruit spot	*Xanthomonas vesicatoria*		
	Leaf spot	*Xanthomonas vesicatoria*		
		Bacillus subtilis		
	Soft rot	*Erwinia atroseptica*		
		Erwinia carotovora		
		Xanthomonas capsici		
	Wilt	*Pseudomonas solanacearum*	Use resistant varieties.	Quebral (1973)
	Fungal diseases			
	Anthracnose	*Colletotrichum nigrum*		
		Colletotrichum phomoides		
	Blight	*Phomopsis vexans*		
		Phytophthora capsici		
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Damping-off	*Pythium debaryanum*		
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Frog-eye	*Cercospora capsici*		
	Fruit rot	*Alternaria* sp.		Micosa and Ilag (1977)
		Colletotrichum nigrum		
		Phoma destructiva		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
		Phytophthora parasitica		
		Vermicularia capsici		
		Fusarium oxysporum		
		Fusarium solani		
	Leaf mold	*Cladiosporium fulvum*		
	Leaf spot	*Septoria lycopersici*		
	Powdery mildew	*Erysiphe* sp.		
	Ripe rot	*Colletotrichum phomoides*		
	Stem-end rot	*Cercospora capsici*		
	Stem rot	*Sclerotium rolfsii*		
	Wilt	*Fusarium oxysporum*		
	Nematode diseases			
	Root-knot	*Meloidogyne arenaria*		
		Meloidogyne incognita		
	Root lesion or rot	*Pratylenchus* spp.		
	Viral diseases			
	Mosaic	Tobacco mosaic virus		
	Yellow mosaic	Unidentified virus		
Pigeon pea	Nematode disease			
	Root-knot	*Meloidogyne javanica*		
Pineapple	Bacterial diseases			
	Fruitlet brown rot	*Erwinia ananas*	Apply potash fertilizer to increase acidity. Fruits of low acidity are most susceptible to disease.	Bondad, *et al.* (1977)
	Fruitlet black rot	*Pseudomonas ananas*		
	Fungal diseases			
	Basal rot	*Phytophthora parasitica*		
	Butt rot	*Thielaviopsis paradoxa*		
	Damping-off	*Sclerotium rolfsii*		
	Heart rot	*Phytophthora parasitica*	Avoid contaminating the 'heart' with soil infected with *P. parasitica* or *P. cinnamomi*. Use well-drained soils on	Bondad, *et al.* (1977)

		infested areas. Plant on raised beds (at least 23 cm high). Provide drainage canals to intercept outside run-off.	
Leaf-base rot	*Thielaviopsis paradoxa*		
Leaf spot	*Asterinella atuhlmanni*		
Root rot	*Phytophthora parasitica*		
Soft rot of fruit	*Thielaviopsis paradoxa*	Treat the fruits within 2 hours after harvesting.	
		Dip them in 1-2% *o*-phenyl phenate, or half of the fruit in 1% sodium salicylanilide solution.	
		Spray or paint the cut end with 2.5% salicylic acid in 30% alcohol solution, or dust the cut surface with 25% benzoic acid.	
		Refrigerate the fruits at 7.2°C.	
White leaf spot	*Thielaviopsis paradoxa*		
Wilt	*Phytophthora* sp.	Avoid contaminating the 'heart' with soil infected with *P. parasitica* or *P. cinnamomi*.	Bondad, *et al.* (1977)
		Use only well-drained soils on infested areas.	
		Plant on raised beds (at least 23 cm high). Provide drainage canals to intercept outside run-off.	
Nematode diseases			
Root-knot	*Meloidogyne incognita*	Avoid frequent replanting of pine-apple in the same field.	Bondad, *et al.* (1977)
		Rotation with pangola grass (*Digitaria decumbens*) has beneficial effects but its economic feasibility is uncertain.	
Root rot or decay	*Rotylenchulus reniformis* *Helicotylenchus* sp. *Criconemoides* sp.		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
		Hoplolaimus sp. *Hemicriconemoides* sp.		
	Viral disease Yellow spot	Unidentified virus		
Potato	Bacterial diseases Blackleg	*Erwinia phytophthora*		
	Soft rot	*Bacillus subtilis* *Erwinia carotovora* *Xanthomonas capsici*		
	Wilt	*Pseudomonas solanacearum*		
	Fungal diseases Black scurf	*Rhizoctonia solani*		
	Damping-off	*Sclerotium rolfsii*		
	Early blight	*Alternaria solani*	Practice crop rotation.	
	Late blight	*Phytophthora infestans*	Practice sanitation in the field, e.g., reduce early-season sources of inoculum (infected seeds, piles of waste).	Bondad, *et al.* (1977)
			Plant resistant cultivars like 'Conchita.' Reduce loss by deep hilling.	
	Leaf spot	*Cercospora batatae*		
	Scab	*Streptomyces scabies*	Practice crop rotation (excluding beets, carrots, fleshy rooted crucifers, and other host crops) for at least 2 years.	Balaoing, *et al.* (1979)
			Keep soil reasonably wet just before or during tuber initiation to reduce severity of the disease.	

		When scab becomes a problem, maintain a low pH of 5.0-5.2. For soils with pH above 5.2, apply acid-forming fertilizers like urea, ammonium sulfate, and other ammonium-containing fertilizers. Avoid practices which increase soil alkalinity.	
Stem rot	*Sclerotium rolfsii*		
Sprout canker	*Rhizoctonia solani*	Practice crop rotation with cereals and other nonhost crops.	Balaoing, *et al.* (1979)
		Shallow planting reduces the exposure time of the sprouts in the soil.	
Tuber rot	*Fusarium* sp.		
Wilt	*Fusarium* sp.		
Nematode diseases			
Root-knot	*Meloidogyne incognita*	Practice crop rotation.	Balaoing, *et al.* (1979)
		Incorporate chicken manure (which is a good medium for nematophagus fungi) with the soil before planting to keep nematode population at a tolerable level.	
		Avoid growing susceptible crops, e.g., beans, sweet potato, tomato, and cucurbits.	
		Practice proper disposal of crop residue by plowing out roots of potato plants immediately after harvest to expose them to sunlight.	
Root lesion or rot	*Pratylenchus* sp.		
Stubby rot	*Trichodorus christei*		
	Rotylenchulus reniformis		
Viral diseases			
Leafroll	Potato leafroll virus	Use certified seed. Spray all adjacent fields.	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Mosaic	Potato viruses, X, Y, S, M		Talens (1979)
	Rugose mosaic	Potato viruses X and Y		
	Ring spot	Potato virus X		
Radish	Bacterial diseases			
	Black rot	*Xanthomonas campestris*		
	Soft rot	*Erwinia carotovora*		
	Fungal diseases			
	Damping-off	*Fusarium* sp.		
		Pythium debaryanum		
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Downy mildew	*Peronospora parasitica*		
	Gray leaf spot	*Alternaria brassicae*		
	Leaf spot	*Cercospora brassicicola*		
	Root rot	*Phoma lingam*		
	White rust	*Albugo candida*		
	Nematode disease			
	Root-knot	*Meloidogyne* spp.		
	Viral disease			
	Mosaic	Unidentified virus		
Rambutan	Bacterial disease			
	Vein necrosis	*Xanthomonas nepheliae*		
	Fungal diseases			
	Fruit rot	Unidentified fungus		
	Rot	*Fomes lignosus*		
	Viral diseases			
	Chlorotic ring spot	Unidentified virus		
	Scaly bark	Unidentified virus		
	Swollen trunk	Unidentified virus		
Ramie	Fungal disease			
	Leaf spot	*Cercospora boehmeriana*	Collect and burn all infected leaves including those that have fallen to the ground.	Clara and Castillo (1950)

	Nematode diseases			
	Brown tip	*Aphelenchoides* sp.		
	Root-knot	*Meloidogyne incognita*		
Rice	Bacterial diseases			
	Leaf blight	*Xanthomonas oryzae*	Use resistant varieties: IR 20, IR 28, IR 36, IR 42, IR 26, IR 29, IR 32, IR 38, IR 30, IR 22, Syntha, Nagkayat, Malagkit, Songsong. Moderately resistant: IR 30, BPI 76.	IRRI (1978, 1979) Ou (1973)
	Leaf streak	*Xanthomonas translucens* f. sp. *oryzicola*	Use resistant varieties: IR 38, IR 20. Moderately resistant: IR 29, IR 38, IR 26, IR 32, IR 36.	IRRI (1978, 1979) Ou (1973) IRRI (undated)
	Fungal diseases			
	Bakanae	*Fusarium moniliforme* *Gibberella fujikuroi*	Treat seeds with organic mercury compound.	IRRI (undated)
	Black kernel smut or true smut	*Tilletia barclayana*		
	Black sheath rot	*Ophiobolus oryzinus*		
	Blast	*Pyricularia oryzae*	Use resistant varieties: IR 42, IR 28, IR 29, IR 32, IR 40, IR 38, IR 36. Moderately resistant: IR 20, BPI 76, C4-63G.	IRRI (1978, 1979) Ou (1973)
			Apply Benlate, Kitazin, Hinosan, EL-291, Dithane M-45.	IRRI (undated)
			Raise seedlings in lowland conditions. Those raised in upland nurseries are more susceptible to blast after transplanting.	
			Reduce nitrogenous fertilization to prevent severe outbreak of blast if rice varieties used are known to be susceptible to blast.	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Brown bordered leaf spot	*Phyllosticta glumarum*		
	Brown or Sesame spot or seedling blight	*Helminthosporium oryzae*	Practice sanitation, crop rotation, adjustment of planting date, proper fertilization, and water management in areas where the disease is endemic.	IRRI (undated)
			Provide proper nutrition for optimum plant growth.	
	Root rot	*Ophiobolus oryzinus*		
	Glume spot	*Phyllosticta glumarum*		
	Green kernel or false smut or green smut	*Ustilaginoidea virens*		
	Leaf scald	*Rhynchosporium oryzae*	Use resistant varieties. Moderately resistant: IR 20, IR 42, IR 30, IR 26.	IRRI (1978, 1979) Ou (1973)
	Leaf smut	*Entyloma oryzae*		
	Linear leaf spot	*Curvularia cymbopogonis*		
	Narrow brown leaf spot	*Cercospora oryzae*	Use resistant varieties: Rexoro, Fortuna, Iola, CI 461, 4440, Darlex, Subonnet, Taro, IR 38. Moderately resistant: IR 36, IR 42, IR 8.	IRRI (1978, 1979) Ou (1973)
			Chemical control: same as control for blast.	IRRI (undated)
	Root rot	*Sclerotium oryzae*		
		Pythium aphanidermatum		
		Pythium gracile		
	Seedling blight	*Corticium rolfsii*	Use resistant varieties: Tjeremas and Peta. Milfor No. 2 and Taichung 1 (Native) appear to be resistant after emergence but not before emergence.	IRRI (undated)
		Helminthosporium sigmoideum		
		Pythium sp.		
		Rhizoctonia solani	Reduce disease incidence by dec-	

	Sclerotium rolfsii	plowing to bury debris on the soil surface.	
		Practice early and thorough cultivation.	
		Flood the affected field with irrigation water after the first symptoms appear to check further development of seedling blight. Do not allow irrigation water to flow from infested soil to clean fields.	
		Keep the seedbed wet. Avoid sites for seedbeds with soil high in organic matter content. Use clean or weed-free seedbeds.	
Sheath blight	*Rhizoctonia solani*	Use resistant varieties: Ching-Kao-Chan, Ching-lin chung, Pingling-Sung 2391, Zenith, Karnorase, DV 112. Moderately resistant: IR 20, IR 42, IR 29, IR 32, IP 38, IR 30, IR 26, IR 8, Tamala Diang, Bahagia, Ta-poo-cho-z.	IRRI (1978, 1979) Ou (1973) IRRI (undated)
		Chemical control: Benlate, Hoe 22843, Topsin M, Validacin, Neoazocin, BASF 3050, Hinosan, Iprodione Rovral.	IRRI (undated)
Sheath rot	*Sclerotium sphaeroides* *Acrocylindrium oryzae*	Use resistant varieties: IR 36, IR 42, IR 32, IR 38.	IRRI (undated) Ou (1973)
Stem rot	*Helminthosporium sigmoideum* *Sclerotium oryzae* *Rhizoctonia solani*	Reduce severity of the disease by adding sodium silicate to the soil, or applying sufficient potash, nitrogen, and phosphate.	IRRI (undated)
		Burn infected rice stubbles after harvest.	
		Drain fields and allow the soil to dry and crack before irrigating again.	
		Reduce disease damage by proper use of fertilizers.	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
			Use resistant nonlodging varieties. Chemical control is not recommended.	
	Stem rotten neck or blast	*Pyricularia oryzae*		
	Stackburn disease	*Alternaria padwickii*		IRRI (undated)
	Nematode diseases			
	Root lesion or rot	*Pratylenchus* spp.		
	Stubby root	*Trichodorus* spp.		
	Stunt	*Tylenchorhynchus* spp.		
	White tip	*Aphelenchoides besseyi*	Use hot water (52-53°C) treatment.	Ou (1973)
			For seed-borne nematodes: presoak the seeds in cool water for 8-12 hours. Preheat them in water at 55°C for 15 seconds. Treat them at 50°C for 15 minutes, and finally dry them.	
	Yellowing of leaf	*Ditylenchus* sp.	Remove or destroy stubbles in the infested field. Plow the field after burning the stubbles. Dry the field for 2-3 months to reduce nematode population.	IRRI (1978, 1979) Ou (1973)
	Viral diseases			
	Orange leaf	Orange leaf virus		
	Tungro	Tungro virus	Use resistant varieties: IR 40, IR 28, IR 29, IR 36. Moderately resistant: IR 26, IR 8, IR 20, IR 42, IR 29, IR 32, IR 38, BPI 76, C4-63G.	IRRI (undated) Ou (1973)
	Ragged stunt or gall	Ragged stunt virus	Use resistant varieties: IR 20, IR 32, IR 38, IR 42. Moderately resistant: IR 26, IR 28, IR 29, IR 30, IR 40.	Ling, *et al.* (1978)
	Grassy stunt	Grassy stunt virus	Use resistant varieties: IR 28, IR 30,	Ling, *et al.* (1978)

			IR 36, IR 42, IR 32, IR 38, IR 40, IR 29. Moderately resistant: IR 26.	
	Mycoplasma diseases Grassy stunt Yellow dwarf Orange leaf			
Rose	Fungal diseases Basal canker	*Cylindrocladium scoparium*		
	Black spot	*Asteroma rosae* *Diplocarpon rosae*	Gather and burn all fallen leaves at the end of the growing season. Prune infected canes without cutting too close to the grafted area.	Pirone (1970)
		Marssomina rosae		
	Crown canker	*Cylindrocladium scoparium*	Use steam-pasteurized soil since the fungus is soil-borne. Plant uninfected stock. Do not wet the leaves when watering.	Pirone (1970)
	Nematode disease Root-knot	*Meloidogyne* spp.		
	Viral disease Mosaic	Rose mosaic virus	Do not use diseased plants for propagation. Destroy them.	Pirone (1970)
Rubber	Fungal diseases Anthracnose	*Colletotrichum gloeosporioides*		
	Bird's eye spot	*Helminthosporium heveae*		
	Black thread	*Phytophthora meadii*	Provide adequate ventilation. Thin out the trees, or prune the branches where shade is too dense. Collect and burn diseased leaves and fruits. Cover tapped surfaces with a mixture of clay and dung sulphur. Dig up	Soria (1978) Teodoro (1926)

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
			dead trees together with the roots and burn them. Burn stumps and all pieces of dead wood.	
	Black root of fruit	*Phytophthora palmivora*		
	Brown root rot	*Hymenochaeta noxic*	Dig up dead trees together with the roots and burn them. Burn stumps and all pieces of dead wood.	Teodoro (1926) Soria (1978)
	Canker	*Phytophthora palmivora*	Scrape and clean cankered bark of large trees. Remove any discolored tissue below the bark.	Teodoro (1926)
	Collar root rot	*Ustulina zonata*	Remove the source of infection. Use collar inspection near the diseased trees to establish the extent of spread.	Soria (1978)
			Follow control measures for brown root rot.	
	Die-back	*Botryodiplodia theobromae* *Colletotrichum gloeosporioides* *Lasiodiplodia theobromae* *Phytophthora palmivora*	Cut and burn diseased trees.	Teodoro (1926)
	Leaf spot	*Cercospora cereae*		
	Mildew	Unidentified fungus		
	Pink disease	*Corticium salmonicolor*	Observe proper spacing and drainage.	
			Avoid too much shading and interplanting other crops.	
	Red rot	*Sphaerostilbe repens*	Destroy and burn affected trees as soon as detected.	Teodoro (1926)
	Root rot	*Fomes lignosus*	Carry out foliage examination once every 3 months in younger areas and three times a year in older ones.	
			Dig and burn all dead stumps or rotting logs.	

			Isolate the infected patches by digging deep trenches (60-90 cm deep) around them.	
	Seedling stem rot	*Pestalozzia palmarum*	Give close attention to the preparation of seedbeds and the care of nurseries. Change the position of the nursery after each crop of seedlings has been raised and the old ground left to lie fallow.	
			Sterilize the soil by heating or by applying formalin.	
	Thread blight or white stem blight	*Cyphella heveae* *Fomes pseudo-ferrous*	Cut off and burn all affected parts.	
	Wet rot	*Poria hypolateritia*	Carry out foliage examination once every 3 months in younger trees and three times a year in older ones.	
			Dig and burn all dead stumps or rotting logs.	
			Isolate the infected patches by digging deep trenches (60-90 cm deep) around them.	
	White stem blight	*Cyphella heveae*	Apply coal tar to white patches. Disinfect with 10% brunolinum plantarum.	
Santol	Fungal disease Seedling blight	*Phytophthora infestans*	Sterilize the soil before planting the seeds.	Coronel and Castillo (1978)
			Follow proper construction of the seedbed. Maintain sanitation.	
Sorghum	Bacterial diseases Leaf streak	*Xanthomonas holcicola*		Benigno (1974) Mercado, *et al.* (1975)
	Leaf stripe	*Pseudomonas andropogoni*	Follow seed treatment procedures. Maintain sanitation.	Barredo (1977) Karganilla and

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Stalk rot	*Erwinia carotovora*		Elasegui (1970)
	Fungal diseases			
	Anthracnose	*Colletotrichum graminicolum*		
	Black or tar leaf spot	*Phyllachora sorghi*		
	Downy mildew	*Sclerospora* sp.	Maintain sanitation by roguing to eliminate the source of inoculum.	
	Grain mold	*Helminthosporium caryopsicum*		
	Gray leaf spot	*Cercospora sorghi*	Burn diseased leaves and plant parts.	
	Kernel smut	*Sphacelothera cruenta* *Ustilago sorghi*		
	Leaf blight	*Helminthosporium turcicum*	Perform seed treatment before sowing.	
	Leaf sheath rot	*Rhizoctonia solani*		
	Leaf spot	*Helminthosporium sorghicola*		
	Root rot	*Pythium debaryanum*		
	Root and stalk rot	*Rhizoctonia solani*	Burn infected plants.	
	Rust	*Puccinea purpurea*		
	Seedling blight	*Rhizoctonia solani*		
	Zonate leaf spot	*Gloeocercospora sorghi*	Use disease-free and/or treated seeds to prevent the spread of the disease.	
	Viral diseases			
	Leaf gall (Fiji disease)	Unidentified virus		
	Mosaic (Red stripe or red leaf)	Sugarcane mosaic virus	Rogue infected plants.	
Soybean	Bacterial disease			
	Pustular spot	*Xanthomonas phaseoli*	Do not work among wet plants.	Quebral (1971, 1974)
			Maintain a 3-year crop rotation.	Quebral, *et al.* (1976)
			Plant high quality disease-free seeds.	
			Plant resistant varieties: UPLB Sy-2, Clark 63, BPI L-114.	Barredo (1977) Ilag, *et al.* (1979)

Fungal diseases			
Black mildew	*Trotteria venturoides*		
Blight	*Rhizoctonia solani*		
Damping-off	*Pythium debaryanum*	Plant best-quality treated seeds in a well-drained fertile soil. Treat seeds with protectant chemicals.	
Downy mildew	*Peronospora* sp.		
Leaf spot	*Cercospora diazu*	Practice crop rotation to reduce source of inoculum.	
Rust	*Uromyces sojae*	Use resistant varieties: BPI-L-114, TK No. 5, Clark 63, UPLB Sy-2.	
	Phakospora pachyrhizi		
Seed decay	*Pythium* sp.	Plant best-quality treated seeds in a well-drained fertile soil. Treat seeds with protectant chemicals.	
Stem rot	*Sclerotium rolfsii*		
	Sclerotinia sclerotiorium		
Wilt	*Fusarium* sp.		
	Sclerotium rolfsii		
Nematode diseases			
Root-knot	*Meloidogyne incognita*		
	M. incognita acrita		
	M. arenaria		
Root rot or decay	*Rotylenchulus reniformis*		
Others	*Heilcotylenchus* sp.		
	Aphelenchus sp.		
Viral disease			
Mosaic	Soybean mosaic virus	Do not use seeds from infected plants as planting materials. Rogue out diseased plants at the first sign of infection in the field. Control aphid vector with proper insecticides.	Ilag, *et al.* (1979) Davide (1975)

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
Squash	Bacterial disease			
	Wilt	*Pseudomonas solanacearum*		
	Fungal diseases			
	Anthracnose	*Colletotrichum lagenarium*		
	Damping-off	*Rhizoctonia solani*		
		Sclerotium rolfsii		
	Downy mildew	*Pseudoperonospora cubensis*		
	Gray fruit rot	*Diplodia natalensis*		
	Powdery mildew	*Erysiphe cichoracearum*		
	Stem-end rot	*Physalospora rhodina*		
	Wilt	*Fusarium oxysporum*		
	Nematode disease			
	Root-knot	*Meloidogyne incognita*		
	Viral disease			
	Mosaic	Squash mosaic virus		
Strawberry	Fungal diseases			
	Black seed disease	*Mycosphaerella fragariae*		
	Fruit rot	*Rhizopus nigricans*		
	Leaf scorch	*Diplocarpon earliana*		
	Leaf spot	*Mycosphaerella fragariae*		
		Mycosphaerella rosigena		
	Powdery mildew	*Uncinula nicator*		
	Stem canker	*Rhizoctonia solani*		
	Nematode disease			
	Root-knot	*Meloidogyne javanica*		
	Viral diseases			
	Crinkle	Unidentified virus		
	Dwarf	Unidentified virus		
	Leaf roll	Unidentified virus		
	Witches' broom	Unidentified virus		
	Yellow	Unidentified virus		
Sugarcane	Bacterial diseases			
	Gummosis	*Xanthomonas vasculorum*		
	Leaf scald	*Xanthomonas albilineans*	Use disease-free planting materials.	Lopez (1967)

		Satisfy at least the optimum nutritional and cultural requirements of the crop.	Reyes and Quebral (1967)
Ratoon stunt	*Corynebacterium* sp.	Use healthy setts for planting. Treat setts obtained from unknown sources.	Lopez (1967) Reyes and Quebral (1967)
Red stripe	*Xanthomonas rubrilineans*		
Stem or stalk rot	*Bacillus sacchari*		
Fungal diseases			
Basal sheath rot or banded sclerotial diseases	*Rhizoctonia solani*	Burn dry leaves and stubbles after harvest. Remove all weeds in the plantation. Practice deep plowing to bury and kill sclerotial bodies.	Lopez (1967) Reyes and Quebral (1967)
Basal stalk rot or basal leaf sheath rot	*Sclerotium rolfsii*		
Brown stripe	*Helminthosporium stenosphilus*		
Damping-off	*Sclerotium sacchari*		
Downy mildew	*Sclerospora sacchari*	Use resistant varieties —	
		Very highly resistant:	
		Phil. 6425	Lapastora, *et al.* (1975)
		Phil. 6317) In Luzon Phil. 6607) In Luzon	Espada and Rivera (1978)
		Phil. 7115	Philsucom (1978)
		Phil. 7104	
		Phil. 7106	
		Phil. 7214	
		Phil. 7215	
		Phil. 7220	
		Phil. 7226	
		Phil. 7228	
		Highly resistant:	
		Phil. 6029	Philsucom (1975)
		Phil. 6421	Lapastora, *et al.*

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
			Phil. 6212 Phil. 6512	(1975) Anonymous (1978)
			Moderately resistant: Phil. 6723	Philsucom (1975)
			Resistant: Phil. 6429 Phil. 6559 Phil. 6614 Phil. 6601	Lapastora, *et al* (1975) Anonymous (1978) Espada and Rivera (1978)
			Do not allow a diseased field to continue with a second growing season.	Rivera (1960)
			Avoid planting corn, sorghum, teosintes, johnson grass, or sudan grass after sugarcane. Do not rotate sugarcane with these crops.	
	Dry sooty rot	*Lasiodiplodia theobromae*		
	Ergot	*Claviceps purpurea*		
	Eye spot	*Helminthosporium sacchari*	Avoid applying too much nitrogen before the spot season.	Reyes and Quebral (1967)
			Practice crop rotation for at least 2 years.	
			Observe sanitation in the field and destroy weed hosts of the disease.	
	Leaf blight	*Leptosphaeria taiwanensis*	Burn the trash after harvest.	Reyes and Quebral (1967)
	Leaf scorch	*Stagonospora sacchari*	Use resistant varieties — Very highly resistant: Phil. 58260 Phil. 7115 Phil. 7177	Lapastora, *et al.* (1975)

		Highly resistant:	
		Phil. 6421	Lapastora, *et al.* (1975)
		Phil. 6512	Espada and Rivera (1978)
		Phil. 5001	Philsucom (1975)
		Phil. 5303	
		Phil. 5333	
		Phil. 58260	
		Resistant:	
		Phil. 6553	Lapastora, *et al.* (1975)
		Phil. 6429	
		Phil. 6614	Espada and Rivera (1978)
		Phil. 7323	
		Phil. 7327	Philsucom (1978)
Leaf spot	*Bakerophoma sacchari* *Cercospora acerosum* *Pestalozzia fuscescens* var. *sacchari* *Phyllachora sacchari*		
Pineapple disease	*Thielaviopsis paradoxa*	Gather, pile, and burn all infected cuttings and stubbles.	Reyes and Quebral (1967)
		Provide good drainage immediately after land preparation.	Lopez (1967)
Pokkah-boeing or top rot	*Fusarium moniliforme*	Grow resistant varieties -- Very highly resistant: Phil. 5001	Philsucom (1975)
		Highly resistant: Phil. 5303, Phil. 5333, Phil. 56226, Phil. 58260	
		Resistant: H-37-1933	Lopez (1967)
Purpie spot or red leaf spot	*Dimeriella saccospora*	Maintain sanitation.	Reyes and Quebral (1967)
Red leaf sheath spot	*Cercospora vaginae*	Use healthy setts for planting.	
		Practice proper cultivation.	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Red rot	*Colletotrichum falcatum*	Use resistant varieties — Highly resistant: Phil. 5001, Phil. 56226, Phil. 58200 Moderately resistant: Phil. 5300, Phil. 5333	Philsucom (1975)
	Rind disease	*Melanconium sacchari*	Maintain sanitation and good tilth. Use good and healthy planting materials.	Reyes and Quebral (1967)
	Ring spot	*Phyllosticta saccharicola*	Practice crop rotation for 2 years using rice, corn, legumes, or vegetables.	Reyes and Quebral (1967)
	Root disease	*Dictyophora phailoidea*		
	Root and stem disease	*Marasmius plicatus*		
	Root and stem rot			
	Root rot	*Pythium arrhenomanes*	Improve the drainage of heavy soils. Apply the right amount and kind of fertilizer.	Reyes and Quebral (1967)
	Rust	*Puccinia kuehnii*	Select healthy planting materials. Diseased field should not be allowed to continue into a second growing season.	Josue (1978)
	Sheath rot and stem canker	*Cytospora sacchari*		
	Smut	*Ustilago scitaminea*	Use resistant varieties — Very highly resistant: Phil. 6723 Phil. 6559 Phil. 7115 Phil. 7177 Phil. 7323	Lapastora, *et al.* (1975) Philsucom (1978)

		Highly resistant:	
		Phil. 6425	Lapastora, *et al.* (1975)
		Phil. 62120	
		Phil. 6317	Anonymous (1978)
		Phil. 5723	Espada and Rivera (1978)
		Phil. 6601	
		Phil. 5333	
		Phil. 6013	Philsucom (1975)
		Phil. 6025	
		Moderately resistant:	
		Phil. 6607	Philsucom (1975)
		Phil. 5001	Philsucom (1975)
		Phil. 5303	
		Phil. 56226	
		Phil. 58260	
		Resistant:	
		Phil. 6553	Lapastora, *et al.* (1975)
		Phil. 6614	Anonymous (1978)
		Phil. 5702	Cano and Rivera (1970)
		Phil. 5885	
		Establish crop rotation using rice, corn, vegetables, or legumes.	Reyes and Quebral (1967)
Sooty mold	*Meliola arundinis*		
Stem rot	*Marasmius sacchari*	Isolate affected areas by digging a trench about 45 cm deep around the diseased canes.	
		Fallow badly affected fields for several years before planting to cane. Practice crop rotation with rice, corn, or field legumes.	
Wilt	*Cephalosporum sacchari*	Practice crop rotation.	
	Sclerotium sacchari		
Yellow spot	*Cercospora kopkei*	Observe sanitation and proper cultural practices.	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Nematode diseases			
	Root-knot	*Meloidogyne* spp.		
	Stunt	*Pratylenchus* spp.		
	Others	*Tylenchorhynchus* spp.		
		Helicotylenchus spp.		
		Rotylenchus sp.		
		Pratylenchus sp.		
	Viral diseases			
	Chlorotic streak	Sugarcane chlorotic streak virus	Improve drainage practices.	
	Fiji disease	Sugarcane Fiji disease virus		
	Mosaic or yellow stripe	Sugarcane mosaic virus		
	Sereh disease	Sugarcane Sereh virus		
	Mosaic	Sugarcane mosaic virus	Discontinue ratooning of fields with infected canes.	Nuedo (1978)
Sunflower	Bacterial diseases			
	Leaf blight	*Pseudomonas helianthi*		
	Shoot blight of seedlings	*Pseudomonas helianthi*		
	Wilt	*Pseudomonas solanacearum*		
	Fungal diseases			
	Damping-off	*Pythium debaryanum*		
	Leaf spot	*Curvularia lunata*		
		Cercosporella sp.		
		Helminthosporium sp.		
	Root and stem rot	*Monilia fructigena*		
	Rust	*Puccinia helianthi*		
	Stem rot	*Fusarium* sp.	Pull out and burn infected plants.	Cardenas (1975)
	Wilt	*Sclerotium rolfsii*	Practice crop rotation with cereals.	
	Nematode disease			
	Root-knot	*Meloidogyne incognita*		

	Viral disease			
	Susceptible viral disease	Unknown		
Sweet Potato	Bacterial diseases			
	Bacterial soft rot	*Erwinia carotovora*	Practice long crop rotation.	Divinagracia (1980)
	Bacterial blight	*Xanthomonas manihotis*	Use healthy planting materials.	Anonymous (1979)
			Use disease-free planting materials.	
			Rogue infected plants as soon as they are observed.	
	Fungal diseases			
	Black rot	*Diplodia tubericola*		
		Lasiodiplodia theobromae		
	Black rot of root and stem	*Endoconidiophora fimbriata*		
	Blight	*Rhizoctonia solani*		
		Sclerotium rolfsii		
	Damping-off	*Rhizoctonia solani*		
		Sclerotium rolfsii		
	Leaf spot	*Cercospora batatae*		
	Stem rot	*Rhizoctonia solani*		
	Soft rot	*Rhizopus nigricans*		
	Stem and foliage scab	*Sphaceloma batatae*		
	Nematode diseases			
	Root-knot	*Meloidogyne incognita*		
		M. javanica		
		M. hapla		
	Root lesion or decay	*Pratylenchus* spp.		
	Others	*Rotylenchus* spp.		
		Helicotylenchus spp.		
	Viral diseases			
	Mosaic	Sweet potato mosaic virus		
	Vein yellowing and stunting	Unidentified virus		
	Feathery mottle	Unidentified		

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Mycoplasma disease Green dwarf or witches' broom			
	Bacterial disease			
	Bacterial blight	Unknown		
	Fungal diseases			
	Anthracnose	*Gloeosporium* sp.		
	Corm rot	*Sclerotium rolfsii*	Clean the corms thoroughly and store them in dry, well-ventilated areas.	Villanueva, *et al.* (1977)
	Leaf blight	*Phytophthora colocasiae*	Avoid close planting especially in shady places. Practice crop rotation. Remove and burn diseased leaves especially in the early stages of the disease when only a few plants are affected. Use healthy planting materials.	Divinagracia (1980)
	Storage rot	*Diplodia tubericola*		
	Leaf spot	*Cercospora* sp. *Alternaria* sp. *Helminthosporium* sp.		
	Viral disease			
	Mosaic	Unidentified virus	Rogue infected plants and control the insect vector.	
Tobacco	Bacterial diseases			
	Black leg	*Erwinia aroideae*		
	Hallow stalk rot	*Erwinia aroideae*		
	Leaf spot	*Pseudomonas aeruginosa*	Remove all infected plants and leaves and burn them. Rinse the treated seeds carefully	Bergonia (1975)

		several times with clean water and allow to dry before sowing.	
		Disinfect seedbeds for starting seedlings and transplant disease-free seedlings.	
Wild fire Bacterial wilt	*Pseudomonas tabaci* *Pseudomonas solanacearum*	Seedbed sites should be far from old vegetable gardens.	Quimio, *et al.* (1979)
		Disinfect all seedbeds.	
		Grow resistant cultivars in rotation with nonsusceptible crops such as corn, rice, and soybean.	
		Construct drainage canals to insure that no surface run-off from infested sites can reach tobacco-growing areas.	
Fungal diseases Black root rot	*Thielaviopsis basicola*	Practice crop rotation in the field such as rice-tobacco, to help prevent fungus build-up in the soil.	
		Use highly tolerant cultivars: Vamorr 48, Vamorr 50, Kentucky 16.	
Black shank	*Phytophthora parasitica* var. *nicotianae*	Practice a combination of crop rotation for 2 years and use of black shank-resistant cultivars: Dixie Bright 102.	
		Disinfect seedbeds by heat. Observe strict sanitation to prevent transfer of fungus from infested field to clean land.	
Damping-off	*Fusarium* sp.	Select well-drained soil for seedbed.	
		Avoid thick seeding. Water sparingly.	
	Phytophthora parasitica *Pythium debaryanum* *P. aphanidermatum*		Puruganan (1978)

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
		P. monospernum *P. ultimum* *Rhizoctonia solani* *Sclerotium rolfsii*		
	Frog eye or cercospora leaf spot	*Cercospora nicotianae*	Correct nitrogen deficiency. Transplant healthy seedlings only. Harvest the leaves before the spot appears. Burn diseased leaves and other parts of the tobacco after harvest.	
	Leaf speck Powdery mildew Root rot	*Macrosporium tabacinum* *Erysiphe cichoracearum* *Sclerotium rolfsii*	Bury all weeds, trash, and other materials on which the fungus grows. Soil containing large amounts of slowly decaying organic matter should not be thrown against the stem of growing plants.	
	Soreshin Stem rot	*Thielavia basicola* *Rhizoctonia solani* *Sclerotium rolfsii*	Bury all weeds, trash, and other materials on which the fungus grows. Soil containing large amounts of slowly decaying organic matter should not be thrown against the stem of growing plants.	
	Wilt	*Fusarium oxysporum* var. *nicotianae*	Use resistant varieties: Dixie Bright 102.	

			Do not rotate tobacco with sweet potato since both crops are susceptible to the same fungus strain.	
	Nematode diseases			
	Root-knot	*Meloidogyne arenaria* *Meloidogyne incognita* *Meloidogyne javanica*		
	Stunt	*Tylenchorhynchus* spp.		
	Viral diseases			
	Leaf curl	Tobacco leaf curl virus	Use resistant cultivars: White Vizbur, Vamorr 48, Vamorr 50.	
			Destroy or rogue out, immediately upon notice, infected plants in the field to reduce source of the disease.	
	Mosaic	Tobacco mosaic virus	Eliminate sources of virus like old crop debris, tobacco products, and weed hosts.	
			Avoid excessive handling of tobacco seedlings. Avoid handling other host plants when working with tobacco.	
			Use resistant cultivars: Viscaya, KY 52, and Amsin.	
Tomato	Bacterial diseases			
	Fruit and leaf spot	*Xanthomonas vesicatoria*	Plant disease-free seeds in areas that have not been cropped to tomatoes for several years.	Quebral (1973)
			Follow seed treatment and weed control measures.	
			Practice crop rotation.	
	Soft rot	*Bacillus subtilis* *Erwinia carotovora* *Xanthomonas capsici*		
	Stem canker	*Xanthomonas vesicatoria*		
	Wilt	*Pseudomonas solanacearum*	Use resistant varieties: VC 11-1UG, VC 48-1 GS, BPI Improved Pope	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
			(tolerant variety), UPL Tm1 (UPL-Tm 73-633-5-3).	
	Fungal diseases			
	Anthracnose	*Colletotrichum phomoides*		
	Blackspot	*Phoma destructiva*		
	Blight	*Sclerotium rolfsii*		
	Damping-off	*Phythium debaryanum*	Sterilize all seedbed soils for starting seedlings.	Orillo, *et al.* (1959)
			Provide ventilation to avoid excessive dampness in the seedbed.	
		Rhizoctonia solani		
		Sclerotium rolfsii		
	Early blight	*Alternaria solani*		
		Fusarium sp.		
		Macrosporium sp.		
		Melanconium lycopersici		
		Phoma destructiva		
		Phytophthora infestans		
		Rhizopus sp.		
		Sclerotium rolfsii		
	Leaf blight	*Helminthosporium lycopersici*		
		Phytophthora infestans		
	Leaf mold	*Cladosporium fulvum*	Plant moderately resistant variety, UPL-Tm 1 (Marikit).	IPB (undated)
		Cercospora fuligena		
	Leaf spot	*Septoria lycopersici*	Plant moderately resistant variety, UPL-Tm 1 (Marikit).	IPB (undated)
	Powdery mildew	*Erysiphe* sp.		
		Leveillula taurica		
	Stem rot	*Sclerotium rolfsii*		
	Wilt	*Fusarium oxysporum* f. sp. *lycopersicon*		
		Sclerotium rolfsii		

	Nematode diseases			
	Root-knot	*Meloidogyne incognita*	Incorporate chicken manure with soil at ½ lb/pot.	Davide and Deanon (1967)
			Plant *Tagetes erecta* (Marigold) at least 1 month before a tomato crop suppresses the egg-hatching ability or infectivity of *M. incognita*.	Ducusin and Davide (1971)
	Root lesion	*Meloidogyne hapla* *Meloidogyne thamesi* *Pratylenchus* spp.		
	Root rot or decay	*Rotylenchus reniformis*		
	Stunt	*Tylenchorhynchus* sp.		
	Viral diseases			
	Fern leaf	Cucumber mosaic virus		
	Leaf curl	Tobacco leaf curl virus		
	Mosaic	Tobacco mosaic virus	Use tolerant varieties, e.g., UPL Tm 1.	**Quebral (1973)**
			Wash hands with soap and water before handling the plants.	
			Workers should refrain from smoking in the field while handling the plants.	
	Yellow leaf curl	Tomato yellow curl virus		
	Mycoplasma disease			
	Big bud			
Watermelon	Bacterial disease			
	Wilt	*Erwinia tracheiphila*		
	Fungal diseases			
	Anthracnose	*Colletotrichum lagenarium*		
	Downy mildew	*Pseudoperonospora cubensis*		
	Fruit rot	*Alternaria cucumeria*		
		Diplodia natalensis		
		Phytophthora parasitica	Reduce loss by carefully sorting and discarding infected fruits before storage and transport.	**Quimio (1974)**

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
	Leaf blight	*Alternaria cucumerina*		
	Leaf spot	*Cercospora citrullina*		
	Powdery mildew	*Erysiphe cichoracearum*		
	Scab	*Cladosporium cucumerinum*	Dip fruits in 2.5% borax solution at 43°C for 30 seconds to control post-harvest development of the disease.	Quimio and Quimio (1974)
	Stem-end rot	*Diplodia natalensis*		
		Fusarium moniliforme var. *subglutinans*		
		Fusarium roseum		
		Fusarium solani		
		Physalospora rhodina		
	Wilt	*Fusarium oxysporum*		
	Nematode disease			
	Root-knot	*Meloidogyne arenaria*		
		Meloidogyne javanica		
	Viral disease			
	Mosaic	Watermelon mosaic virus		
Wheat	Fungal diseases			
	Blight	*Rhizoctonia solani*		
	Culm canker	*Rhizoctonia solani*		
	Culm or leaf sheath rot	*Sclerotium rolfsii*		
	Head blight	*Fusarium avenaceum*		
	Leaf spot	*Curvularia lunata*		
		Helminthosporium sativum		
		Rhizoctonia solani		
		Pythium arrhenomanes		
	Root rot or wilt	*Sclerotium rolfsii*		
	White foot rot	*Rhizoctonia solani*		

Winged bean	Fungal diseases		
	False rust or orange gall	*Synchytrium psophocarpi*	
	Leaf spot	*Pseudocercospora psophocarpi*	Quebral, *et al.* (1980)
	Powdery mildew		
	Nematode disease		
	Root-knot	*Meloidogyne incognita*	
	Viral disease		
	Cowpea mosaic virus	Unidentified virus	Talens and Talens (1979)
Yam	Bacterial disease		
	Black rot	Unidentified bacterium	
	Fungal diseases		Divinagracia (1980)
	Anthracnose	*Colletotrichum* sp.	
	Black leaf spot	*Phyllachora ubi*	
	Cercospora leaf mold	*Cercospora* sp.	
	Dry rot	*Diplodia* sp.	
	Leaf spot	*Macrophoma* sp.	
		Cercospora pachyderma	
		Cercospora ubi	
		Mycrosphaerella dioscoricola	
		Phyllachora rehmiana	
		Phyllosticta dioscoreae	
	Rust	*Uredo dioscoreae alata*	
		Goplana dioscoreae	
	Storage rot	*Lasiodiplodia theobromae*	
		Rhizopus nigricans	

Table 10. (Continued)

Crops	Diseases[a]	Causal Organisms[a]	Control Measures	References
Yardlong bean	Fungal diseases			
	Leaf spot	*Cercospora cruenta*		
	Rust	*Uromyces phaseoli* var. *vignae*		
	Nematode diseases			
	Root-knot	*Meloidogyne arenaria*		
		Meloidogyne incognita		
		Meloidogyne javanica		
	Root lesion or rot	*Pratylenchus* spp.		
	Viral disease			
	Mosaic	Unidentified virus		Mercado, *et al.* (1975)

[a]Benigno, D.A. and F.C. Quebral. 1977. Host Index of Plant Diseases in the Philippines. UPCA, College, Laguna, Philippines.

Table 11. Host range of plant pathogens in the Philippines

Pathogens	Host Plants
Bacteria	
Agrobacterium tumefaciens	Grapes
Bacillus mangiferae	Mango
B. sacchari	Mungo
B. subtilis	Onion, pepper, potato, tomato
Bacterium stewarti	Corn
Corynebacterium sp.	Sugarcane
Erwinia ananas	Pineapple
E. aroideae	Tobacco
E. atroseptica	Pepper
E. caricae	Papaya
E. carotovora	Cabbage, carrot, cauliflower, celery, cucumber, eggplant, garlic, lettuce, onion, orchid, pechay, pepper, potato, radish, sorghum, sweet potato, tomato
E. carotovora var. *chrysanthemi*	Corn, sorghum
E. phytophthora	Potato
E. tracheiphila	Cucumber, watermelon
Pseudomonas aeruginosa	Tobacco
P. atrosprecipitans	Corn
P. alicola	Onion
P. ananas	Pineapple
P. andropogoni	Corn, sorghum
P. caryophylli	Carnation
P. cattleyae	Orchids
P. cepacia	Onion
P. helianthi	Sunflower
P. phaseoli	Lima bean
P. solanacearum	Abaca, banana, bean, bitter gourd, cotton, eggplant, ginger, peanut, pepper, potato, squash, sunflower, tobacco, tomato
P. syringae	Citrus
P. tabaci	Tobacco
P. woodsii	Carnation
Xanthomonas albilineans	Sugarcane
X. campestris	Cabbage, cauliflower, pechay, radish
X. capsici	Onion, pepper, potato, tomato
X. citri	Citrus
X. holcicola	Sorghum
X. malvacearum	Cotton
X. manihotis	Cassava, sweet potato
X. nepheliae	Rambutan
X. oryzae	Rice

Table 11. (Continued)

Pathogens	Host Plants
Fungi	
Acrocylindium oryzae	Rice
Aithalodema longisetum	Coffee
Albugo candida	Cauliflower, pechay, radish
Alternaria brassicae	Cabbage, cauliflower, lettuce, pechay, radish
A. cucumerina	Watermelon
A. diathi	Carnation
A. herculae	Pechay, cauliflower, radish
a. porri	Garlic, onion
A. solani	Potato tomato
A. spp.	Cotton, pepper, taro
Armillaria mellea	Coffee
Ascochyta gossypii	Cotton
A. pinodes	Pea
Aspergillus niger	Mango, onion
Asterinella atuhlmanni	Pineapple
Asteroma phaseoli	Bean
A. rosae	Rose
Bakerophoma sacchari	Sugarcane
Botryodiplodia theobromae	Banana, cacao, corn, grapes, papaya, rubber
Botryosphaeria ribis	Avocado
Botrytis allii	Onion
B. cinerea	Carnation, grapes
B. sp.	Chrysanthemum
Bremia lactucae	Lettuce
Capnodium brasiliensis	Coffee
C. citri	Citrus
C. footii	Coconut
C mangiferum	Mango
Cephalosporium sacchari	Sugarcane
C. sp.	Coffee
Cercosperella sp.	Sunflower
Cercospora abelmoschi	Okra
C. acerosum	Sugarcane
C. apii	Celery
C. armoraciae	Pechay
C. artocarpi	Breadfruit, jackfruit
C. batatae	Potato, sweet potato
C. boehmeriana	Ramie
C. brassicicola	Cabbage, cauliflower, pechay, radish

Table 11. (Continued)

Pathogens	Host Plants
C. canescens	Common bean
C. capsici	Pepper
C. cereae	Rubber
C. citrullina	Watermelon
C. coffeicola	Coffee
C. cruenta	Mungbean, yardlong bean
C. chrysanthemi	Chrysanthemum
C. diazu	Soybean
C. duddiae	Garlic, onion
C. fuligena	Tomato
C. hayi	Banana
C. henningsii	Cassava
C. hibisci	Cotton, kenaf, okra
C. kopkei	Sugarcane
C. lactucae	Lettuce
C. lussoniensis	Lima bean
C. mangiferae	Mango
C. manihotis	Cassava
C. melongena	Eggplant
C. musae	Banana
C. nicotianae	Tobacco
C. oryzae	Rice
C. pachyderma	Yam
C. papayae	Papaya
C. personata	Peanut
C. purpurea	Avocado
C. rosicola	Rose
C. sorghi	Sorghum
C. ubi	Yam
C. vaginae	Sugarcane
C. vicosae	Cassava
C. viticola	Grapevine
C. sp.	Banana, chayote, cowpea, cucumber, gumamela, lablab (hyacinth) bean, mulberry, mussaenda, taro, yam
Cladosporium cucumerinum	Muskmelon, watermelon
C. fulvum	Eggplant, pepper, tomato
C. herbarum	Citrus, lima bean
Claviceps purpurea	Sugarcane
Colletotrichum agaves	Maguey
C. circinans	Onion
C. coffeanum	Coffee
C. falcatum	Sugarcane
Colletotrichum gloeosporioides	Avocado, citrus, grapes, guava, mango, orchids, papaya, rubber
C. gossypii	Cotton

Table 11. (Continued)

Pathogens	Host Plants
C. graminicolum	Corn, sorghum
C. lagenarium	Cucumber, muskmelon, squash, watermelon
C. lindemuthianum	Common bean, cowpea, lima bean, mungbean
C. melongena	Eggplant
C. musae	Banana
C. nigrum	Pepper
C. papayae	Papaya
C. sp.	Anthurium, milflores, sampaguita, yam
Coniothyrium coffeae	Coffee
C. zingiberi	Ginger
Cordana musae	Banana
Corticium rolfsii	Rice
C. salmonicolor	Cacao, citrus, coffee, jackfruit, mango, rubber
C. vagum	Carnation
Cryptosporella viticola	Grapes
Curvularia cymbopogonis	Rice
C. inaepualis	Corn
C. lunata	Gladiolus, sunflower, wheat
C. sp.	Corn
Cylindrocladium scoparium	Rose
Cyphella heveae	Rubber
Cytospora sacchari	Sugarcane
Diaporthe citri	Citrus
Dictyophora phalloidea	Sugarcane
Dimeriella sacchari	Sugarcane
Diplocarpon earliana	Strawberry
D. rosae	Rose
Diplodia agaves	Maguey
D. crebra	Banana
D. degenerans	Eggplant
D. duriones	Durian
D. lablab	Lablab (hyacinth) bean
D. macrospora	Corn
D. natalensis	Avocado, citrus, mango, squash, watermelon
D. phaseolina	Bean, lima bean
D. theobromae	Cacao, sweet potato
D. tubericicola	Cassava, sweet potato, taro
D. zeae	Corn
D. sp.	Banana, cotton, jackfruit, rose, ubi, yam, yautia

Table 11. (Continued)

Pathogens	Host Plants
Elsinoe ampelina	Grapes
E. fawcetti	Citrus
E. mangiferae	Mango
Endoconidiophora fimbrieta	Sweet potato
Entyloma oryzae	Rice
Epicoccum cocos	Coconut
Erysiphe cinchoracearum	Cucumber, muskmelon, squash, tobacco, watermelon
E. polygoni	Mungbean, pea
E. sp.	Common bean, cowpea, papaya, pepper, tomato
Exosporium durum	Coconut
Fomes lamaoensis	Citrus, coffee
F. lignosus	Cassava, rambutan, rubber
F. pseudo-ferrous	Rubber
Fusarium avenaceum	Wheat
F. coffeicola	Coffee
F. moniliforme	Corn, Cotton, rice, sugarcane
F. moniliforme var. *subglutinans*	Abaca, watermelon
F. oxysporum	Cucumber, eggplant, muskmelon, onion, pepper, squash, watermelon
F. oxysporum sp. *cepae*	Garlic
F. oxysporum conglutinans	Cabbage, cauliflower, pechay
F. oxysporum var. *cubense*	Abaca, banana
F. oxysporum dianthi	Carnation
F. oxysporum gladioli	Gladiolus
F. oxysporum sp. *lycopersicon*	Tomato
F. oxysporum nicotianae	Tobacco
F. poae	Carnation
F. roseum	Banana, muskmelon, watermelon
F. solani	Bean, citrus, papaya, pepper, watermelon
F. solani f. sp. *phaseoli*	Mungbean
F. sonatum	Onion
F. spp.	Banana, cacao, coffee, chrysanthemum, citrus, coconut, corn, cotton, cowpea, lettuce, onion, papaya, pechay, potato, radish, soybean, sunflower, tobacco, tomato, watermelon, wheat
Gloeocercospora sorghi	Sorghum
Gloeosporium musarum	Abaca, banana
G. psidii	Guava
G. sp.	Anthurium, begonia, cacao, taro
Glomerella cingulata	Avocado, banana, black pepper, citrus, coffee, eggplant, grapes, mango, orchids, papaya, pepper, rubber

Table 11. (Continued)

Pathogens	Host Plants
Goplana dioscorea	Yam
Guinardia bidwelli	Grapes
Helminthosporium caryopsidium	Sorghum
H. gossypii	Cotton
H. haloides	Coconut
H. heveae	Rubber
H. inconspicuum	Corn
H. incurvatum	Coconut
H. lycopersici	Tomato
H. maydis	Corn
H. oryzae	Rice
H. papayae	Papaya
H. sacchari	Sugarcane
H. sativum	Wheat
H. sigmoideum	Rice
H. sorghicola	Sorghum
H. stenosphilus	Sugarcane
H. torulosum	Abaca, banana
H. turcicum	Corn, sorghum
H. sp.	Taro, sunflower
Hemeleia vastatrix	Coffee
Heterosporium exhinulatum	Carnation
Hymenochaeta noxia	Rubber
Hypomyces haematococus	Cacao
Isariopsis griseola	Bean
Kuenneola fici var. *moricola*	Mulberry
K. gossypii	Cotton
Lasiodiplodia theobromae	Cacao, citrus, papaya, rubber, sugarcane, sweet potato, yarn
Leptosphaeria saccnari	Sugarcane
Leptothyrium circumscissum	Mango
Leveillula taurica	Tomato
Loranthus philippinensis	Mango
Macrophoma corchori	Jute
M. musae	Abaca, banana
M. phaseoli	Corn, jute
M. sp.	Yam
Macrophomina phaseoli	Corn
Macrosporium carotae	Carrot
M. parasiticum	Onion
M. tabacinum	Tobacco
M. sp.	Pepper, tomato

Table 11. (Continued)

Pathogens	Host Plants
Marasmius pernicious	Cacao
M. plicatus	Sugarcane
M. sacchari	Sugarcane
M. semiustus	Abaca
Marssomina rasol	Rose
Melanconium lycopersici	Tomato
M. sacchari	Sugarcane
Miliola arundinis	Sugarcane
M. citricola	Citrus
M. mangiferae	Mango
Micropeltis mucosa	Coffee
Minolia fructigena	Sunflower
Mucor sp.	Citrus
Mycosphaerella caricae	Papaya
M. dioscoricola	Yam
M. fijiensis	Banana
M. fragariae	Strawberry
M. rosigena	Strawberry
Nectaria bainii var. *hypoleuca*	Cacao
N. theobromas	Cacao
Nematospora sp.	Citrus
Oidium tangitanium	Citrus
O. sp.	Avocado, milflores
Olpidium brassicae	Cabbage
Ophiobolus oryzinus	Rice
Oespora citriaurantii	Citrus
Pellicularia koleroga	Coffee
Penicillium digitatum	Citrus
P. gladioli	Gladiolus
P. italicum	Citrus
P. sp.	Papaya
Peronoplasmopara cubensis	Bitter gourd, cucumber, muskmelon, pea, watermelon
Peronospora destructor	Garlic, onion
P. parasitica	Cabbage, cauliflower, pechay, radish
P. sp.	Soybean
Pestalozzia funerea	Mango
P. fuscescans var. *sacchari*	Sugarcane
P. palmarum	Mango
P. pauciseta	Mango
Phakospora pachyrrhizi	Soybean
Phoma bakeriana	Cowpea

Table 11. (Continued)

Pathogens	Host Plants
P. citricarpa	Citrus
P. destructor	Pepper, tomato
P. lingam	Cabbage, pechay, radish
P. sabadariffae	Kenaf
P. terrestris	Garlic, onion
P. sp.	Coffee
Phomopsis citri	Citrus
P. vexans	Eggplant, pepper
Phyllachora phaseolina	Common bean
P. rehmiana	Yam
P. sacchari	Sugarcane
P. sorghi	Sorghum
P. ubi	Yam
P. sp.	Mango
Phyllactinia suffulta	Mulberry
P. sp.	Rose
Phyllosticta dioscoreae	Yam
P. glumarum	Rice
P. hortorum	Eggplant
P. insularum	Soursop
P. manihoticola	Cassava
P. saccharicola	Sugarcane
P. zingiberi	Ginger
Phymatotrichum omnivorum	Cotton
Physalospora rhodina	Muskmelon, squash, watermelon
P. zeicola	Corn
Physoderma maydis	Corn
Physopella vitis	Grapes
Phytophthora capsici	Pepper
P. cinnamomi	Avocado
P. citrophthora	Citrus
P. colocasiae	Taro
P. infestans	Potato, santol, tomato
P. meadii	Rubber
P. melongena	Eggplant
P. palmivora	Cacao, coconut, orchids, papaya, rubber
P. parasitica	Muskmelon, papaya, pepper, pineapple, tobacco, watermelon
P. parasitica var. *nicotianae*	Tobacco
P. phaseoli	Lima bean
P. terrestria	Citrus
P. sp.	Citrus, mango, pineapple
Piricularia grisea	Banana
P. oryzae	Rice

Table 11. (Continued)

Pathogens	Host Plants
Placosphaeria durionis	Durian
Plasmodiophora brassicae	Cabbage, cauliflower, pechay
Plasmopara viticula	Grapes
Poria hypolateritia	Rubber
Pseudoperonospora cubensis	Cucumber, muskmelon, squash, watermelon
Pseudocercospora psophocarpi	Winged bean
Puccinia arachidis	Peanut
P. helianthi	Sunflower
P. kuehnii	Sugarcane
P. polysora	Corn
P. porri	Onion
P. purpurea	Sorghum
P. sorghi	Corn
P. tubulosa	Eggplant
Pythium aphanidermatum	Cucumber, eggplant, lettuce, pechay, rice, tobacco
P. arrhenomanes	Sugarcane, wheat
P. arrhenomanes var. *philippinensis*	Corn
P. debaryanum	Avocado, bean, cabbage, cauliflower, celery, cotton, cowpea, cucumber, eggplant, kenaf, lettuce, lima bean, okra, papaya, pea, pechay, pepper, radish, sorghum, soybean, sunflower, tobacco, tomato
Pythium gracile	Rice
P. monospermum	Tobacco
P. ultimum	Tobacco
P. spp.	Corn, rice, soybean
Ramularia areola	Cotton
Rhizoctonia solani	Avocado, bean, cabbage, cacao, carrot, cauliflower, celery, citrus, coffee, corn, cotton, cowpea, cucumber, eggplant, jute, kenaf, lettuce, lima bean, mango, mungbean, papaya, pea, peanut, pechay, pepper, potato, radish, rice, sorghum, soybean, squash, strawberry, sugarcane, sweet potato, tobacco, tomato, wheat
R. zeae	Corn
Rhizopus artocarpi	Breadfruit, jackfruit
R. nigricans	Avocado, cassava, citrus, jackfruit, onion papaya, strawberry, sweet potato, yam
R. stolonifer	Papaya
R. sp.	Tomato

Table 11. (Continued)

Pathogens	Host Plants
Rhynchosporium oryzae	Rice
Rosellinia bunodes	Coffee
R. zingiberi	Ginger
Schizophyllum commune	Cotton
Sclerospora philippinensis	Corn
S. spontenea	Corn
S. sp.	Sorghum
Sclerotinia libertiana	Cabbage
S. sclerotiorum	Soybean
Sclerotium cepivorum	Garlic, onion
S. delphiniae	Mango
S. oryzae	Rice
S. rolfsii	Bean, bitter gourd, cabbage, carnation, cassava, cauliflower, celery, citrus, coffee, corn, cotton, cucumber, eggplant, jackfruit, kenaf, lettuce, onion, orchid, papaya, pea, peanut, pechay, pepper, pineapple, potato, radish, rice, soybean, squash, sugarcane, sunflower, sweet potato, taro, tobacco, tomato, wheat
Sclerotium sacchari	Sugarcane
S. sphaeroides	Rice
S. sp.	African violet
Septobasidium pseudopedicellatum	Citrus
Septogloeum arachidis	Peanut
Septoria api	Celery
S. dianthi	Carnation
S. lablabina	Lablab bean
S. lycopersici	Eggplant, pepper, tomato
S. sp.	Rose
Sphaceloma batatae	Sweet potato
S. perseae	Avocado
S. sp.	Banana
Sphacelothera cruenta	Sorghum
Sphaerotheca pannosa	Rose
Sphaerostilbe repens	Cacao, rubber
Stagonospora sacchari	Sugarcane
Stilbella flavida	Coffee
Streptomyces scabies	Potato
Synchytrium psophocarpi	Winged bean
Thielavia basicola	Tobacco

Table 11. (Continued)

Pathogens	Host Plants
Thielaviopsis basicola	Tobacco
T. paradoxa	Banana, coconut, mango, pineapple, sugarcane
Tilletia barclayana	Rice
Trametes personii	Durian
Trotteria venturoides	Soybean
Uncinula nicator	Grapes, strawberry
Uredo artocarpi	Breadfruit
U. dioscoreae alata	Yam
Uracystis cepulae	Garlic, onion
Uromyces appendiculatus	Common bean, cowpea, mungbean
U. caryophillinus	Carnation
U. musae	Banana
U. phaseoli var. *typica*	Common bean
U. phaseoli var. *vignae*	Cowpea, yardlong bean
U. sojae	Soybean
U. sp.	Gladiolus
Ustilaginoidea virens	Rice
Ustilago maydis	Corn
U. scitaminea	Sugarcane
U. sorghi	Sorghum
Ustilina zonata	Rubber
Vermicularia capsici	Pepper
Verticillium alboatrum	Avocado, cotton, kenaf
V. theobromae	Banana
Viscum orientale	Mango
Woroninella dolochi	Lablab bean
Nematodes	
Aphelencoides besseyi	Orchids, rice
A. sp.	Ramie
Aphelencus sp.	Cassava, peanut, soybean
Criconemoides	Banana, cassava, pineapple
Ditylenchus dipsaci	Garlic, onion
D. sp.	Cassava, rice
Helicotylenchus multicinctus	Banana
H. sp.	Abaca, banana, black pepper, cassava, celery, coconut, corn, cowpea, eggplant, papaya, peanut, pineapple, soybean, sugarcane, sweet potato

Table 11. (Continued)

Pathogens	Host Plants
Hemicriconemoides spp.	Banana, pineapple
Hoplolaimus spp.	Abaca, banana, black pepper, cassava, lima bean, pineapple
H. coronatus	Corn
Meloidogyne arenaria	Bitter gourd, ginger, grapes, okra, pepper, soybean, tobacco, watermelon, yardlong bean
M. arenaria-thamesi	Bitter gourd, lettuce, tomato
M. hapla	Cabbage, eggplant, sweet potato, tobacco, tomato
Meloidogyne incognita	Abaca, banana, bitter gourd, black pepper, carrot, cassava, cauliflower, celery, chayote, cotton, cowpea, cucumber, dahlia, eggplant, ginger, grapes,jute, kenaf, lanzones, muskmelon, papaya, pea, pechay, pepper, pineapple, potato, ramie, soybean, squash, sunflower, sweet potato, tobacco, tomato, winged bean, yardlong bean
M. incognita-acrita	Soybean
M. javanica	Abaca, bitter gourd, cabbage, cauliflower, cowpea, garlic, lablab bean, jute, lettuce, mungbean, muskmelon, okra, pepper, strawberry, sweet potato, tobacco, watermelon
M. sp.	Abaca, bean, coffee, coconut, lima bean, onion, radish, rose, sugarcane, tomato, yardlong bean
Pratylenchus coffeae	Banana
P. reniformis	Mungbean
P. zeae	Corn
P. sp.	Abaca, bean, cabbage, cassava, celery, cowpea, citrus, coffee, eggplant, garlic, kenaf, lettuce, okra, pepper, papaya, pea, pechay, potato, rice, sugarcane, sweet potato, tomato, yardlong bean
Radopholus similis	Abaca, banana
Rotylenchulus reniformis	Abaca, banana, coffee, cotton, cowpea, grapevine, papaya, peanut, pineapple, potato, soybean, tomato
R. sp.	Black pepper, coconut, eggplant, lima bean, mungbean
Rotylenchus sp.	Banana, cassava, sweet potato, sugarcane

Table 11. (Continued)

Pathogens	Host Plants
Scutellonema sp.	Cassava
Trichodorus sp.	Bean, cabbage, celery, corn, onion, pechay, rice
T. christei	Potato
Tylenchulus cemipenetrans	Citrus, grapes
Tylenchorhynchus spp.	Banana, black pepper, cabbage, cassava, coconut, corn, cowpea, cucumber, eggplant, garlic, lettuce, lima bean, okra, onion, peanut, rice, sugarcane, tobacco, tomato
Xiphinema sp.	Abaca, coconut

Table 12. Fungicides recommended for controlling various fungal diseases of crops grown in the Philippines

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Diseases Controlled
Benomyl	Benlate 50 WP	Banana	Anthracnose, crown rot
		Bean	Rust, powdery mildew
		Grapes	Anthracnose, rust, powdery mildew
		Mungbean	Leaf spot
		Muskmelon/watermelon	Powdery mildew
		Rice	Powdery mildew, rice blast, narrow brown leaf spot, leaf scald
		Roses	Powdery mildew
		Tobacco	Frog-eye
		Tomato	Leaf mold, powdery mildew
Captafol	Agri Captafol 80W Agri Difclatan 4F Haipen 4F	Corn	Stalk rot, blight, kernel blast
		Cotton	Verticillium wilt
		Grapes	Downy mildew

Table 12. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Diseases Controlled
		Onion	Purple blotch
		Orchids (*V. lamellata*)	Black rot
		Pineapple	Heart rot
		Roses	Black spot
		Tobacco	Damping-off
Captan	Agri Captan 50 W	Cabbage	Head rot
		Carnation	Wilt, rust
	Captex 50 WP Merpan WP 50 Orthocide 50 WP	Corn	Root rot
		Cotton	Verticillium wilt, anthracnose, bacterial blight, boll rot
		Chrysanthemum	Leaf spot
		Grapes	Anthracnose, black rot
		Papaya	Cercospora fruit rot
		Pineapple	Heart rot
		Potato	Late blight, scab
		Soybean	Damping-off or seed decay
		Tobacco	Frog-eye or leaf spot, damping-off
		Watermelon/ cantaloupe	Scab, stem-end rot, fusarium rot
		Winged bean	Orange gall or false rust
Chloroneb	Demosan 65% WP	Sorghum	Stalk rot
		Soybean	Damping-off or seed decay
		Tobacco	Damping-off
Chlorothalnil	Daconil	Chrysanthemum	Leaf spot
		Orchid	Black rot or heart rot
		Peanut	Leaf spot, black spot
		Potato	Late blight, early blight
		Sorghum	Anthracnose

Table 12. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Diseases Controlled
		Soybean	Damping-off
Copper Fungicide	Kocide 101 Kocide SD	Avocado	Anthracnose
	Cupravit Blue 35%		Fruit rot or blotch
	Vitigran Blue		Scab
	Cupravit 50% WP	Carnation	Leaf spot
	Bourdeaux Mixture	Citrus	Melanose, pink disease, anthracnose bark rot, damping-off, powdery mildew, canker
		Coffee	Coffee rust, die-back, damping-off
		Grapes	Downy mildew, rust, black rot
		Potato	Late blight
		Watermelon/ cantaloupe	Phytophthora rot
		Winged bean	Orange gall
Dimethirimal	Milcurb 12.5%	Tomato	Powdery mildew
		Cucurbits	Powdery mildew
		Melon	Powdery mildew
Dinocap	Karathane WP	Beans	Powdery mildew
		Citrus	Powdery mildew
		Grapes	Powdery mildew
		Roses	Powdery mildew
Edifenphos	Hinosan	Rice	Rice blast
Fentin hydroxide	Telustan 600 WP	Mungbean	Anthracnose
	Duter 50% WP	Potato	Late blight
Folpet	Phalton 50 WP	Grapes	Downy mildew, anthracnose
Mancozeb	Dithane M-45	Bean	Rust
		Cabbage	Gray leaf spot
		Cassava	Leaf spot
		Citrus	Anthracnose

Table 12. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Diseases Controlled
		Corn	Downy mildew
		Cucurbits	Downy mildew
		Chrysanthemum	Leaf spot
		Grapes	Downy mildew, anthracnose, gray mold or botrytis rot, rust, powdery mildew, anthracnose
		Mungbean	Rust
		Onion	Bulb rot, cercospora leaf spot, purple blotch
		Orchids	Black rot
		Papaya	Anthracnose
		Potato	Late blight, early blight, scab
		Roses	Black rot, black spot
		Sorghum	Rust, helminthosporium leaf spot
		Soybean	Rust
		Tobacco	Frog-eye, leaf spot
		Tomato	Bacterial fruit and leaf spot, leaf mold, late blight
	Manzate 200 80% WP Manzate 200	Citrus	Foot rot
Maneb	Agri Maneb 80% WP Dithane M-22 Maneb 80% WP Plantineb 80 WP Polyram M 80% WP Manzate 80 WP Nespor 80 WP	Banana	Bark rot, gummosis Black spot/speckle disease
		Bean	Rust
		Cabbage	Gray leaf spot, alternaria blight
		Cassava	Leaf spot
		Chrysanthemum	Leaf spot
		Corn	Rust

Table 12. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Diseases Controlled
		Cotton	Soreshin, damping-off, boll rot, bacterial blight, anthracnose
		Grapes	Downy mildew, anthracnose, gray mold, rust, powdery mildew
		Mungbean	Rust, anthracnose
		Papaya	Cerscospora fruit spot
		Peanut	Rust
		Potato	Late blight, early blight
		Sorghum	Leaf spot
		Soybean	Leaf spot, rust
		Tobacco	Frog-eye, leaf spot
		Watermelon/ muskmelon	Scab, stem-end rot, fusarium rot
		Winged bean	Leaf spot
Propineb	Antrocol M-80 WP	Grapes	Downy mildew, powdery mildew
PCNB Pentachloro-nitrobenzene	Brassicol 75 WP	Cabbage	Head rot
		Cotton	Damping-off
		Potato	Sprout canker, black scurf
		Soybean	Stem rot
Pyrazophos	Afugan	Rose	Powdery mildew
Thiabendazole	Tecto	Banana	Crown rot, anthracnose
		Grapes	Anthracnose
Thiophanate-methyl	Topsin 70% WP Fungitox 70% WP	Chrysanthemum	Fusarium wilt
		Grapes	Gray mold or botrytis rot
Thiram	Arasan 50 WP Arasan 75 WP Tersan 75	Corn	Ear rot, leaf blight, stalk rot, kernel blast, leaf spot
		Cotton	Boll rot, anthracnose, bacterial blight

Table 12. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Diseases Controlled
		Potato	Stem canker, black scurf
		Sorghum	Seedling blight, seed rot
		Soybean	Damping-off
		Watermelon/ muskmelon	Anthracnose
Zineb	Zineb 80% Zineb Zineb 80 WP Fungizin 80 WP Tiezene Turbair Zineb	Banana	Crown rot, black spot, speckle disease
		Cabbage	Gray leaf spot
		Cassava	Leaf spot
		Carnation	Rust
		Corn	Rust, leaf spot, leaf blight
		Cotton	Soreshin, damping-off, verticillium wilt, fusarium wilt
		Papaya	Cercospora fruit spot
		Peanut	Black spot
		Soybean	Leaf spot
		Tobacco	Frog-eye
		Watermelon/ muskmelon	Stem-end rot, fusarium rot, downy mildew
		Winged bean	False rust (orange gall), leaf spot

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Insect and Mite Pests

Insect and mite pests constitute another group of biological constraints in crop production. Like diseases, these pests also damage the crop which results in very low yields and market value. Severe infestations may result in total crop failure. Insect attack may start from sowing to harvesting, storage, and up to the final consumption.

These pests chew vital plant parts, tunnel marketable portions, and suck plant juices which consequently lead to loss of vigor or death of the affected part. Aside from this, some insects like aphids, leafhoppers, and planthoppers serve as agents for the spread of virus diseases. Also, insect damage facilitates the entrance of other disease-causing organisms.

Control of these pests therefore is necessary to prevent their direct damage to the crop, and indirect damage through the spread of virus diseases. Knowledge of what insect or mite pests to control and of their host plants could serve as guides in determining suitable control measures.

Table 13 presents the common and scientific names of insect and mite pests of crops grown in the country. Cultural and biological control measures against these pests are also included whenever available.

Table 14 lists the recommended pesticides for controlling insect and mite pests of various crops and supplements the control measures presented in Table 13. The effectiveness of these pesticides is temporary and recommendations may change more often than expected. The change in recommendations may be due to the development of insect resistance to the pesticides and the availability of less hazardous but more effective chemicals.

Table 15 shows a list of pests and crops that they affect or attack. Pests are classified into four groups (sucking insects, chewing insects, boring insects, and mites). They have several subgroups to indicate their mode of attack and taxonomic classification.

This section does not include descriptions, life histories, habits, and nature of damage of the pests since this information can be gathered from several publications dealing with specific crops or pests.

Table 13. Insect and mite pests of crops grown in the the Philippines

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
Abaca	Sucking insect attacking the leaves			
	Brown aphid	*Pentalonia nigronervosa*	Control brown aphids with insecticides. Eradicate diseased plants.	Anunciado, *et al.* (1977)
	Chewing insects			
	Attacking the corms and suckers			
	Corm weevil	***Cosmopolites sordidus***	Keep plantation clean.	Anunciado, *et al.* (1977)
	Attacking the leaves			
	Slug caterpillar	***Thosea sinensis***	Cut and destroy infested leaves.	Anunciado, *et al.* (1977)
Avocado	Sucking insects			
	Attacking the leaves and shoots			
	Mealybugs			
	*Gray mealybug	*Ferrisia virgata*	Use lime wash as repellant to lessen infestation.	Coronel (1980)
	*Filamentous mealybug	*Nipaecoccus filamentosus*	Oil emulsion spray is effective in controlling these pests.	
	*Cottony cushion mealybug	*Planococcus lilacinus*		
	Armored scale			
	*Coconut scale	*Aspidiotus destructor*	Use lime wash as repellant to lessen infestation.	Coronel (1978)
	*Avocado scale	*Fiorinia fioriniae*	Oil emulsion spray is usually effective in controlling this pest.	
	Attacking the fruits			
	Oriental fruit fly	*Dacus dorsalis*	Do not leave fruits to ripen on the tree.	Coronel (1978)

Banana	Sucking insects attacking the flowers and fruits			
	Banana thrips	*Thrips florum* *Elixothrips brevisetis* *Hercinothrips femuralis*	Plant clean setts.	Gabriel (1976)
	Mealybug	*Pseudococcus* sp.		
	Chewing insects attacking the fruits			
	Banana weevil	*Cosmopolites sordidus*	Use clean planting materials.	Gabriel (1976)
			Biological control: histerid beetle *Plaesius javanicus*. Other beetles found to attack this insect: *Halslepta quadidenata*, *Bactylosternum hydrophiloides*, Leptid fly (*Chrysophilus ferruginexus*).	
			Use resistant varieties: Panama, Valery, and Manzao.	
	Scarring beetles	*Philicoptus iliganus*	Wrap bunches with plastic bags to control the injury.	Gabriel (1976)
Beans (cowpea, mungbean, yardlong bean, soybean, and common beans)	Sucking/mining insects attacking the leaves and stems			
	Beanfly	*Ophiomyia phaseoli*	Practice crop rotation.	Sanchez, *et al.* (1980)
			Avoid late seeding.	Deanon and Soriano (1967)

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Chewing insects attacking the leaves			
	Leaf folder	*Homona coffearia* *Lamprosema indicata*		
	Boring insects attacking the flowers and pods			
	Bean pyralid (mung moth)	*Maruca testulalis*		
	Bean pod borer	*Estiella zinckenella*		
Black pepper	Sucking insects			
	Attacking the leaves			
	Thrips	*Gynaikothrips chavicae*		
Breadfruit, jackfruit	Sucking insects			
	Attacking the leaves and shoots			
	Mealybugs			
	*Gray mealybug	*Ferrisia virgata*		
	*Cottony cushion mealybug	*Planococcus lilacinus*		
	*Filamentous mealybug	*Nipaecoccus filamentosus*		
	Armored scale			
	*Florida red scale	*Chrysomphalus ficus*		
	*California red scale	*Aonidiella aurantii*		
	*Champaca scale	*Morganella longispina*		
	*Ginging scale	*Pseudaonidia trilobitoformis*		
	Soft scale	*Pulvinaria psidii*		
	Giant coccids	*Drosicha townsendi* *Icerya seychellarum*		
	Chewing insects			
	Attacking the roots			
	Root grubs	*Anomala* sp. *Leucopholis irrorata*		
	Attacking the trunks and branches			

	Nasute termite	*Nasutitermes luzonicus*	Remove affected branches to reduce infestation.	Coronel (1977)
	Cerambycid bark borer	*Betocara rubus*		
	Shot-hole borer	*Platypus jansoni*		
	Coffee carpenter moth	*Zeuzera coffeae*		
	Attacking the leaves and shoots			
	Pyraustid caterpillar	*Diaphania ceasalis*		
	Attacking the fruits			
	Nangka fruit fly	*Dacus umbrosus*	Protect fruits from fruit flies by wrapping them with used cement bags, sacks, newspaper, or other similar materials.	Coronel (1977)
Cacao	Sucking insects attacking the fruits and pods			
	Cacao pod borer	*Acrocercops cramerella*		
	Capsids	*Helopeltis collaris*	Catch insects by hand. Destroy them by applying flame to the pods. Introduce a black ant (*Doliderchus bituberculatus*) to the cacao field. This ant does not attack the capsids but makes the trees unattractive to them.	Urquhart (1956)
	Chewing/boring insects attacking the stems, leaves, and fruits			
	Cacao shot-hole borer	*Xyleborus* sp.		
	Pachyrrhynchid beetle	*Pachyrrhynchus moniliferus*		
	Cacao tussock moth	*Orgyia australis postica*		Sanchez and Laigo (1968)

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
Cashew	Boring insects attacking the trunks and branches			
	Mango twig borer	*Niphonoclea albata* *N. capito*	To reduce infestation, shake the branches, collect the fallen beetles, and burn them.	Coronel (1977)
	Attacking stored nuts			
	Rice weevil	*Sitophilus oryzae*	Fumigation can control the pest.	Coronel (1977)
	Attacking the roots and trunks			
	Cashew weevil	*Mococaryous coripes*	Remove grubs as soon as detached.	Coronel (1977)
Cassava	Sucking insects attacking leaves			
	Florida red scale	*Chrysomphalus ficus*	Use clean planting materials.	
	Soft scale	*Saissaetia nigra* *S. coffeae*	Cut and burn infested plants to prevent spread of infestation.	Belotti and Schoonhoven (1978)
	Mealybugs			
	*Gray mealybug	*Ferrisia virgata*		
	*Hibiscus mealybug	*Phenacoccus hirsutus*		
	White fly	*Bemisia tabaci*	Eliminate wild host plants. Biological control: Coccinelid *Serangium cinctum* preys on immature mites. The mite *Tryphialocromite* sp. feeds on adults. The wasp, *Prospaltella* sp., has been reported to parasitize white flies.	Belotti and Schoonhoven (1978)
	Chewing insects attacking the roots and stems			

	Mound building termite	*Macrotermes gilvus*		
	Urambycid borer	*Dihammus vastator*		
	Attacking the leaves			
	Corn silk beetle	*Meriolepta bifasciata*		
	Mites			
	Spider mites	*Tetranychus telarius* *T. kanzawai*		Belotti and Schoonhoven (1978)
Celery	Sucking insects attacking the leaves			
	Green peach aphid	*Myzus persicae*		
	Chewing insect attacking the leaves			
	Cutworms	*Spodoptera litura*		
Citrus	Sucking insects attacking the fruits			
	Green bug	*Rhynchocoris longirostris*	When infestation is heavy and persistent, remove cover crops temporarily. Use parasitizing wasps such as *Telenomues latisulcus* and *Anastatus stantoni* on female bugs and eggs.	Coronel, *et al.* (1980)
	Scales			
	*Purple scale	*Lepidosaphes beckii*		
	*Snow scale	*Pinnaspis* sp.		
	*Glover scale	*Lepidosaphes gloverii*		
	*Green scale	*Coccus viridis*		
	Attacking the leaves			
	Jumping plant lice or citrus phylla	*Diaphorina citri*		

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Mites			
	Red spider	*Panonychus citri*	Carry out chemical control during the warmer hours of the day when the mites are agile, so that in all probability, they will make contact with the chemical.	Coronel, *et al.* (1980)
	Sucking insects attacking the leaves, flowers, and fruits			
	Florida red scale	*Chrysomphalus aonidum*	Natural control: Use the following parasites: *Phycus flaviventris, Comperiella bifaciata, Casca chinensis, Marieta* sp.	PCA (1974)
	Coconut scale	*Aspidiotus destructor*	Biological control (predators): Many species under the family Coccinellidae feed on coconut scale insects. These are: *Chilocorus nigutis, C. circumdatus, Telsemia cyclonica, Nephus* sp., *Aphytis chrysomphali.*	PCA (1974) Talibullah and Gabriel (1975)
	Chewing insects			
	Attacking the trunks			
	Coconut black beetle	*Oryctes rhinoceros*	Maintain sanitation. Use baculovirus and green muscardine fungus.	PCA (1974)
	Shot-hole beetle	*Xyleborus perforane*	Plant cover crops to reduce breeding isles.	

Attacking the cabbage			
Coconut black beetle	*Oryctes trituberculatus* *Xylotrupes gideon* *Chalcossoma atlas*		
Attacking the trunks and cabbage			
Asiatic palm weevil	*Rhynchophorus schach*	Treat injured portions with coal tar. Conduct a regular survey to detect the presence of pests at early stage of attack.	PCA (1974)
	R. ferrugineus		
Four spotted coconut weevil	*Diocalandra frumenti*		
Attacking the leaves			
Coconut leaf miner	*Promecotheca cumingii*	Natural control: Use chalcid wasps to parasitize these insects. Cut off systematically infested leaves under close and expert supervision.	PCA (1974)
Slug or nettle caterpillar group			
*Blue striped slug caterpillar	***Parasa lepida***	Use biological control agents such as tachinid fly, braconid wasps (*Eurytoma* sp., *Apanteles* sp., *Spinaria* sp., *Brachymeria* sp.,	Pacumbaba (1975)

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
			Phanerotoma sp., *Takastemus* sp., *Charos* sp., white muscardine fungus, and *Serratia marcescens*).	
			Plant leguminous cover crops.	
	•Pagui-pagui	*Thosea sinensis*		
	•Gelatine caterpillar	*Cheromellia comatrensi*		
	•Oriental migratory locust	*Locusta migratoria*		
	Attacking the roots			
	White grub	*Leucopholis coneopliora*		
	Attacking the flowers			
	Lemon spike moth	*Batracehedra arenosella*		
	Coconut greater spike moth	*Tirathaba* sp.	Maintain sanitation by burning infected buttons.	Abad (1978)
	Two-colored hispid beetle	*Plesispa* sp.		
	Mites			
	Spider mites	*Oligonychus velascoi*	Use natural enemies like Coccinelid beetles and predatory mite species.	Gabriel (1975) Cayme (1980)
	Eriophyid mites	*Pritchardina fijiensis* *Acathrix trymatus* *Dialox stallatus* *Notostrix attenuata* *Scolocenus spiniferus*		
	Tenuipalpid mites	*Tenuipalpus orilloi*		
Coffee	Sucking insects attacking the shoots and leaves			
	Scale insects	*Coccus viridis* *Saissetia coffeae*		
	Chewing insects attacking the berries and flowers			
	Coffee berry borer	*Hypothenemus hampei*	To control and prevent	Creencia, *et al.*

		further development of the berry borer in harvested berries, soak them in hot water for about 10-15 minutes, or dry with hot air until moisture content is 12% or less.	(1976) Rejesus and Baldos (1979)
		Keep the plantation free from ripe berries for 3 months.	Ocampo (1976)
		Prune excess branches of shade trees to expose coffee trees to sunlight.	
		Harvest early, before July ripening of the berries.	
Black coffee twig borer	*Xylosandrus compactus*	Avoid the practice of pruning and topping coffee trees to 1 m high. This encourages lateral branching where the secondary and tertiary branches develop every year. The insect bores through the current-year twigs and forms galleries inside causing wilting and later breaking up of twigs.	Gabriel (1980)
Red coffee borer Coffee bean weevil	*Zeuzera coffeae* *Araecerus fasciculatus*	Proper aeration of storage area; fumigation by phostoxin methyl bromide.	Ocampo (1976)
Sucking insects attacking the leaves			

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Corn aphids	*Rhopalosiphum maidis*	Encourage natural enemies (Coccinellids and syrphid flies).	Gabriel (1971)
	Corn leafhopper	*Peregrinus maidis*	It seldom needs control measure because its population is kept dow.. by natural enemies.	
	Ear thrips	*Frankliniella williamsi*		
	Attacking the roots			
	Mealybug or pineapple mealybug	*Dysmicoccus brevipes*	Practice crop rotation.	Gabriel (1971)
	Root aphids	*Tetraneura nigriabdominalis* *Geocia lucifurga*		
	Chewing insects			
	Attacking the leaves			
	Armyworms			
	Black or African armyworm	*Spodoptera exempta*		
	Grass armyworm	*S. mauritia*		
	True armyworm	*Pseudalatia separata*		
	Grasshoppers and katydid			
	Long-horned grasshopper	*Euconocephalus varius* *Phaneroptera furcifera*		
	Short-horned grasshopper	*Ailopus tamulus* *Attractomorpha psittacina* *Gastrimargus marmoratus transversus* *Trilophidia annulata*		
	Citrus green locust	*Melicodes tenebrosa* *Locusta migratoria manilensis*	Catch fliers using nets and drive hoppers into pits.	Gabriel (1971)
	Cutworm			
	Spotted cutworm	*Agrotis ipsilon*	Visit the field regularly to	Gabriel (1971)

		detect any signs of infestation.	
Common cutworm Cutworm	*Spodoptera litura* *Leucania loreyi* *Mocis trugalis*		
Corn leaf-eating caterpillar	*Dinara combusta*		
Leaf roller	*Parnara guttatus mangala*		
Attacking the roots			
Grubs			
Root grubs	*Adoretus* sp. *Anomala* spp. *Holotrichia* spp.		
White grubs or June beetles	*Leucopholis irrorata*	Control grubs by plowing and exposing immature beetles to the surface.	
Crickets			
Black cricket Brown cricket	*Gryllus bimaculatus* *G. testaceus*	Practice thorough preparation of the field.	Gabriel (1971)
Attacking the tassel, silk, ears, and leaves			
Corn earworm	*Helicoverpa armigera*	Practice crop rotation. Do not use susceptible plants in succession.	Gabriel (1971)
Corn semi-looper	*Chrysodeixis chalcites*	Observe proper timing of planting to evade the abundance of the beetle.	
Corn silk beetle	*Monolepta bifasciata*	Use trap crops.	
Boring insects			
Attacking the stems			
Pink aphids	*Sesamia inferens*		
Yellow maize moth Peach moth	*Dichocrosis punctiferalis*		

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Attacking the tassel, ears, stem, and leaves			
	Corn borer	*Ostrinia furnacalis*	Cut infected plants close to the ground and feed them to animals, or bury them in the soil.	Gabriel (1971)
			Plant early. Plant contiguous areas at the same time.	
			Practice crop rotation. Eliminate weeds.	
	Corn seedling maggot	*Atherigona oryzae*	Practice clean culture including removal of alternate host plants.	
	Yellow sugarcane borer	*Chilo infuscatellus*		
Cotton	Sucking insects			
	Attacking the leaves			
	Thrips	*Thrips tabaci*		
	Cotton stainers	*Dysdercus* spp.		
	Mealybug	*Ferrisia virgata*		
	Leafhopper	*Amrasca bigutulla*		
	Chewing insects			
	Attacking the leaves			
	Leafworm	*Spodoptera litura*		
	Cutworm	*Anomis erosa*		
	Leaf roller	*Sylepta derogata*		
	Attacking the bolls, flowers, and buds			
	Cotton boliworm	*Helicoverpa armigera*	Practice deep plowing of crop residue after harvesting.	Newsom and Brazzil (1968)
	Spiny bollworm	*Earias cupreovirides*		

	Mites			
	Spider mite	*Tetranychus* spp.		
Crucifers (cabbage, cauliflower, pechay, radish)	Sucking insects attacking the leaves and flowers			
	Green peach aphid	*Myzus persicae*		
	Chewing insects attacking the leaves and flowers			
	Cabbage worm	*Crocidolomia binotalis*		
	Diamond-back moth	*Plutella xylostella*		
	Cutworm	*Spodoptera litura*		
	Earworm	*Helicoverpa armigera*	In Thailand, juice is squeezed from dead yellow worms hanging on the leaves. It is diluted to 1:1000 and sprayed on the plants in the evening at the rate of 750 L/ha.	Bantoc (1967)
	Cabbage butterfly	*Pieris canidia*		
Cucurbits (bitter gourd, bottle gourd, chayote, cucumber, dishrag gourd, muskmelon, squash, water-melon, wax gourd)	Sucking insects			
	Attacking the vines			
	Sweet potato bug	*Physomerus grossipes*		Gabriel (1974)
	Attacking the leaves and flowers			
	Pentatomid bugs			
	Dapdap bug	*Cyclopelta obscura*		
	Green soldier bug	*Nezara viridula*		
	Tomato mirid bug	*Crytopeltis (Nesidiocarpes) tenuis*		
	Leafhoppers	*Euttetix* sp.		
		Bothrognia ferruginea		
	Cotton leafhopper	*Amrasca biguttula*		
	Green rice leafhopper	*Nephotettix nigropictus*		
	Black leafhopper	*Ricania speculum*		
	Aphids			
	Melon aphid	*Aphis gossypii*		

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Bean aphid	*A. craccivora*		
	Green peach aphid	*Myzus persicae*		
	Citrus aphid	*Toxoptera aurantii*		
		T. pitricida		
	Mealybug	*Ferrisia virgata*		
	Hemispherical scale	*Saissetia coffeae*		
	Tobacco thrips	*Thrips tabaci*		
	Attacking the stems and shoots			
	Squash bug	*Leptoglassus australis*		
	Attacking the fruits			
	Fruit flies	*Dacus cucurbitae*		
		D. mundus		
		D. hageni		
	Chewing insects			
	Attacking the leaves and flowers			
	Katydids or long-horned grasshopper	*Mecopoda elongata*		
		Phaneroptera furcifera		
	Tomato lady beetle	*Epilachna philippinensis*		
	Squash beetle	*Aulacophora cottigarencis*		
		A. flavomargirata		
		A. sinvillis		
	Cutworms and armyworms	*Agrotis segetum*		
		Pseudaletia separata		
		Spodoptera litura		
	Corn earworm	*Helicoverpa armigera*		
	Squash semi-looper	*Anadenida peporis*		
	Leaf folders	*Diaphania indica*		
		Hymena recurvalis		
	Cabbage worm	*Crocidolonia binotalis*		
	Tiger moth caterpillar	*Dasychira mendosa*		
	Attacking the roots			

	Root grub	*Anomala humeralis* *Leucopholis irrorata*		
	Boring insects			
	Attacking the vines			
	Vine borer	*Apomecyna historion* *A. neglecta*		
	Cucurbit boring borid	*Manilaboris cucurbitae*		
	Mites	*Tetranychus truncatus*		
Durian	Boring insects			
	Attacking the branches, stems, and twigs			
	Coffee carpenter moth	*Zeuzera coffeae*		
	Attacking the fruits			
	Durian borer	Unidentified decophorid		
	Peach moth	*Dichocrocis punctiferalis*		
Garlic and Onion	Sucking insects attacking the leaves			
	Thrips	*Thrips tabaci*	Use early maturing varieties and overhead sprinkler irrigation. Allow bulbs to mature to have minimum loss.	Deanon and Cadiz (1967)
	White fly	*Bemisia tabaci*		
	Chewing insects			
	Attacking the leaves			
	Cutworms	*Agrotis ipsilon* *Calogramma festiva* *Spodoptera exigua* *S. litura*		
	Corn earworm (tomato fruitworm)	*Helicoverpa armigera armigera*		
	Leaf folder	*Homona coffearia*		

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Attacking the bulbs			
	Angoumois grain moth	*Sitotroga cerealella*		
	Cacao moth or tobacco moth	*Ephestia elutella*		
	Cigarette beetle	*Lasioderma serricorne*		
	Mites	*Aceria tulipae*	Fumigate bulbs with methyl bromide before storage. Recommended dosage is 2 cans (2 lb) of methyl bromide per 27 m^3 of fumigated space at 26.5°C for 2 hours. When dealing with small quantities of seed bulbs, dip them for 20 minutes in a solution of miticide or insecticide before storage.	Deanon and Cadiz (1967)
Ginger	Sucking insects attacking the leaves			
	Ubi scale	***Aspidiella hartii***		
	Luya scale	***A. zingiberi***		
	Chewing insect attacking the roots			
	Ginger root borer	*Mimegralla coeruleifrons*		
Grapes	Sucking insects			
	Attacking the leaves			
	Chinese wax scale	*Ceroplastes sinensis*		
	Oriental scale	*Aonidiella orientalis*		
	Gray mealybug	*Ferrisia virgata*	Use biological control methods and natural enemies such as lady beetle and other parasites.	Schwartz (1975)

	Tree hopper	*Tricentrus convergens*	Wash off grapevines with water.
	Attacking the fruits		
	Fruit fly	Unidentified	
	Chewing insects attacking the leaves		
	Scarabaeid beetle	*Adoretus* sp.	
	Bagworm	*Eumeta fuscescens*	
	Sweet potato hornworm	*Agrius convolvuli*	
	Grape skeletonizer	Unidentified zygaenid	
Guava	Sucking insects		
	Attacking the leaves and shoots		
	Guava leafhopper	*Thaumatoseopus reflexus*	
	Aphids		
	Melon aphid	*Aphis gossypii*	
	Guava aphid	*Greenidea formosana*	
	Mealybugs		
	Gray mealybug	*Ferrisia virgata*	
	Cotton cushion mealybug	*Planococcus lilacinus*	
	Giant coccids	*Crypticerya jacobsoni*	
		Drosicha townsendi	
		Icerya seychellarum	
	Attacking the leaves		
	Soft scales		
	Green scale	*Coccus viridis*	
	Wax scale	*Ceroplastes rubens*	
		C. sinensis	
		C. cajani	
	Black scale	*Saissetia nigra*	
	Hemispherical scale	*S. coffeae*	
	Guava soft scale	*Pulvinaria psidii*	

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Armored scales			
	Coconut scale	*Aspidiotus destructor*		
	Florida red scale	*Chrysomphalus ficus*		
	Mirid bugs	*Helopeltis bakeri*		
	Chewing insects			
	Attacking the stems and branches			
	Scolytid borer	*Hypothenemus psidii*		
	Termites	*Nectermes* sp.		
	Attacking the leaves and shoots			
	Chrysomelid beetle	*Phytorus* sp.		
	Lycaenid caterpillar	*Catochrysops cnejus*		
	Noctuid caterpillar	*Autoba grisescens*		
	Fruit piercing moth	*Othreis fullonia*		
	Peach moth	*Dichocrosis punctiferalis*		
	Slug caterpillar	*Thosea sinensis*		
	Tussock caterpillar	*Lymantria lunata*		
		Metanastria hyrtaca		
	Bagworm	*Eumeta variegata*		
	Olethreutid caterpillar	*Strepsicrates ejectana*		
	Atlas moth	*Attacus atlas*		
	Attacking the fruits			
	Fruit flies			
	Oriental fruit fly	*Dacus dorsalis*		
	Melon fruit fly	*D. cucurbitae*		
	Vinegar fly	*Drosophila ananassae*		
	Mites attacking the leaves			
	Tetranychid mites	*Eotetranychus spanius*		
		Oligotetranychus biharensis		
Jute	Chewing insects attacking leaves			
	Cutworms	*Anomis erosa*		Gabriel (1974)
		A. sabulifera		
		Chrysodeixis chalcites		
		Spodoptera litura		

Kenaf	Sucking insects		
	Attacking the leaves		
	Green stink bug	*Nezara viridula*	Gabriel (1974)
	Melon aphid	*Aphis gossypii*	
	Gray mealybug	*Ferrisia virgata*	
	Cotton cushion mealybug	*Planococcus lilacinus*	
	Black scale	*Saissetia nigra*	
	Leafhopper	*Amrasca biguttula*	
	White fly	*Aleurocanthus spinosus*	
	Attacking the stems		
	Mirid bug	*Helopeltis bakeri*	
	Tube dweller	*Machaerota ensifera*	
	Tree hopper	*Gangara luconica*	
		Leptocentrus manilanensis	
		Tricentrus plicatus	
		Sipylus sp.	
	Attacking the shoots, stems, and leaves		Gabriel (1974)
	Hemispherical scale	*Saissetia coffeae*	
	Other scales	*Hemiberlesia lutaniae*	
		Lepidosaphis rubro vittatus	
		Pinnaspis aspidistrae	
	Attacking the fruits and seeds		
	Cotton earworm	*Helicoverpa armigera*	
	Cotton bollworm	*Earias fabia*	
	Cotton stainers	*Dysdercus cingulatus*	
		D. poecilus	
	Attacking the flowers		
	Cotton boliworm weevil	*Amorphoidea lata*	
	Pink bollworm	*Pectinophora gossypiella*	

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Chewing insects attacking the roots			Gabriel (1974)
	White or root grubs	*Anoniala* sp.		
		Leucopholis irrorata		
	Red fire ant	*Solenopsis geminata rufa*		
	Long-horned grasshopper	*Phaneroptera furcifera*		
	Abutilon moth	*Anomis erosa*		
	Cutworms	*Anomis sabulifera*		
		Spodoptera litura		
		Xanthodes transversa		
	Other leaf-eating caterpillars	*Diaphania indica*		
		Sylepta derogata		
	Tussock moth caterpillar	*Euproctis varians*		
	Slug caterpillar	*Parasa lepida*		
	Measuring caterpillar	*Hyposidra talaca*		
	Spotted ladybird beetle	*Epilachna philippinensis*		
	Corn silk beetle	*Monolepta bifasciata*		
	Flea beetle	*Nisotra gemella*		
	Leaf feeding beetles	*Amphimela meroorum*		
	Boring insects attacking the stems	*Phyllotreta* sp.		
	Coffee carpenter moth	*Zeuzera coffeae*		
	White-back twig borer	*Niphonoclea albata*		
	Mites	*Oligonychus velascoi*		
Lanzones	Sucking insects			
	Attacking the leaves and shoots			
	Mealybugs			Gabriel (1974)
	Gray mealybug	*Ferrisia virgata*		
	Filamentous mealybug	*Nipaecoccus filamentosus*		
	Cottony cushion mealybug	*Planococcus lilacinus*		
	Soft scales			
	Green scale	*Coccus viridis*		
	Aster scale	*Asterolecanium* sp.		
	Armored scale	*Lepidosaphes* sp.		
	Black aphid	*Toxoptera aurantii*		

Attacking the leaves			
White fly	*Aleurocanthus* sp.		
Bugs			
Shield bug	*Brachyplatya deplanatus*		
Mirid bug	*Helopeltis* sp.		
Lace bug	*Stephanitis typicus*		
Cotton stainer	*Dysdercus cingulatus*		
Chewing insects			
Attacking the stems and branches			
Nasute termite	*Nasutitermes luzonicus*		
Mound building termite	*Macrotermes gilvus*		
Mango twig borer	*Niphonoclea albata*		
	N. capito		
	Coelosterna pulcheliator		
	Dihammus sp.		
	Thestus sp.		
Shot-hole borer	*Xyleborus* sp.		
Lepidopterous borer			
Lanzones borer	*Cossus* sp.	Brush off loose dried barks to expose the larvae. Brushing should be done before the flower buds appear, otherwise these buds will be injured.	Coronel (1977)
Green moth	*Prasinoxena* sp.		
Red-banded bark-borer	*Ereunitis* sp.	Carefully scrape the loose barks and kill the exposed larvae.	
White bark-borer	*Eratmocera* sp.		
Attacking the leaves and shoots			
Night beetle	*Adoretus ranunculus*		
Chrysomelid beetle	*Phytorus* sp.		
Snow beetle	*Mecopus* sp.		

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Measuring caterpillar	*Hyposidra* sp.		
	Atlas moth	*Attacus atlas*		
	Tussock caterpillar	*Lymantria* sp.		
	Leaf roller	*Homona* sp.		
	Slug caterpillar	*Thosea sinensis*		
	Bagworm	*Eumeta fuscescens*		
	Attacking the fruits			
	Ants			
	Red fire ant	*Solenopsis geminata rufa*		
Maguey/Sisal	Sucking insects			
	Attacking the leaves			
	Pineapple mealybug	*Dysmicoccus brevipes*		Gabriel (1974)
	Coconut scale	*Aspidiotus destructor*		
	Fern scale	*Pinnaspis aspidistrae*		
	California red scale	*Aonidiella aurantii*		
	Attacking the roots			
	Pineapple mealybug	*Dysmicoccus brevipes*		
	Chewing insects			
	Attacking the roots			
	White or root grubs	*Leucopholis irrorata*		
	Mites	*Dolichotetranychus floridanus*		
Mango	Sucking insects			
	Attacking the leaves and shoots			
	Banded leafhoppers	*Typhlocyba nigrobilincata*		
	Mango hoppers	*Tachardina minuta*		
	Attacking fruits and leaves			
	Red banded thrips	*Selenothrips rubrocinctus*		
	Attacking the trunks, fruits, flowers, leaves, roots, and terminal shoots			
	Mealybugs			
	Gray mealybug	*Ferrisia virgata*	Spray the ants to lessen	Custodio, *et al.*

		their movement and population build-up.	(1975)
Cottony cushion mealybug	*Pseudococcus lilacinus*		
Tortoise shell	*Puerto spinosus*		
	P. mangiferae		
Scale insects			
Coconut scale	*Aspidiotus destructor*	Spray the ants to lessen their movement and population build-up.	
Green scale	*Coccus viridis*		
Shield scale	*Pulvinaria polygonata*		
	P. psidii		
Wax scale	*Vinsonia stillifera*		
Others	*Aonidilia inonata*		
	A. orientalis		
	Coccus mangiferae		
	Lepidosaphes sp.		
	Phenacaspes inday		
	Tarchardia menuta		
	Icarya scychellarum		
Chewing and boring insects			
Attacking the fruits			
Oriental fruit flies	*Dacus dorsalis*	Wrap or bag the fruits.	Custodio, *et al.* (1975)
		Spray the flies with bait.	
		Maintain sanitation: Collect fallen fruits and properly dispose them into deep pits. Spray with Malathion and cover them with	

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
			soil. Burn them using gasoline or dry leaves.	
		D. cucurbitae		
	Attacking the seeds			
	Mango seed borer	*Noorda albizonalis*		
	Boring insects attacking the twigs, panicles, and young shoots			
	Mango tip borer	*Chlumeta transversa*	Cut off affected shoots and twigs and burn them before spraying.	Custodio, *et al.* (1975)
	Mango twig borer	*Niphonoclea albata*		
		N. capito		
Mulberry	Sucking insects attacking the leaves			
	Filamentous mealybug	*Nipaecoccus filamentosus*		Gabriel (1974)
	Giant coccid	*Icerya aegyptiaca*		
	Black scale	*Saissetia nigra*		
	California red scale	*Aonidiella aurantii*		
	Chewing insects attacking the leaves			
	Cutworm	*Spodoptera litura*		
	Castor silkworm	*Philosamia ricini*		
	Weevils	*Mecopus hopei*		
		M. bispinosus		
Okra	Sucking insects			
	Attacking the leaves and stems			
	Soft scales			
	Black scale	*Saissetia nigra*		
	Hemispherical scale	*Saissetia hemisphaerica*	Use planting materials that are free of scales.	Esguerra and Gabriel (1969)
	Armored scales			
	Coconut scale	*Aspidiotus destructor*		
	Fern scale	*Pinnaspis aspidistrae*		
	Tampoi scale	*Lepidosaphes rubrovittatus*		

Attacking the fruits			
Cotton stainers	*Dysdercus cingulatus* *D. poecilus*	Start control measures as soon as young nymphs appear.	Esguerra and Gabriel (1969)
Attacking the leaves and buds			
Cottony cushion mealybug	*Pseudococcus lilacinus*		
Attacking the twigs and pods			
Scutellerid bug	*Tectocoris diopthalmus* *perigrina*		
Chewing insects			
Attacking the leaves			
Corn silk beetle	*Monolepta bifasciata*		
Flea beetle	*Nisotra gemella*	Remove wild host plants.	Esguerra and Gabriel (1969)
Cutworm	*Xanthodes transversa*		
Leaf-eating caterpillar	*Sylepta derogata*		
Measuring caterpillar	*Hyposidra talaca*	Handpick and destroy cocoons instead of caterpillars since the latter are armed with irritant spines.	Esguerra and Gabriel (1969)
		Destroy remaining crops in the field.	
Tussock moth caterpillar	*Suana concolor*		
Attacking the leaves, fruits, flowers, buds and shoots			
Abutilon moth	*Cosmophila erosa*		
Cotton bollworm	*Earias fabia*	Destroy all damaged shoots before the fruits form.	Esguerra and Gabriel (1969)
		Remove and destroy all plants in the field after harvest.	

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
			Destroy alternate host plants.	
	Jute semi-looper	*Anomis sabulifera*		
	Red fire ants	*Solenopsis geminata rufa*		
	Boring insects attacking the trunks, branches, and stems			
	Coffee carpenter moth (Red coffee borer)	*Zeuzera coffeae*		
Orchids	Sucking insects			
	Attacking the leaves			
	Thrips	*Dichromothrips corbetti*		
	Scale insects			
	Proteus scale	*Parlatoria proteus*	Scrub off the insects with a soft brush. Rinse the plant thoroughly with water. Allow it to dry and spray.	Valmayor, *et al.* (1977)
	Morgan scale	*Chrysomphalus dictyospermi*		
	Others	*Leucaspis cockerelli*		
		Pinnaspis townsendi		
	Attacking the roots			
	Mealybugs	*Pseudococcus adonidium*		
	Gray mealybug	*Ferrisia virgata*		
	Pineapple mealybug	*Pseudococcus brevipes*		
	Citrus mealybug	*Planococcus citri*		
	Chewing insects			
	Attacking the leaves			
	Greenish-brown grasshopper	*Phaneroptera furcifera*		
	Attacking the flowers, leaves, and roots			
	Weevils	*Orchidophilus aterimus*	Handpick the weevils.	
		O. peregrinator		

	Root grubs	*Leucopholis irrorata*	Handpick the larvae and eggs.	Valmayor, *et al.* (1977)
	Phalaenopsis lycaenid	*Chliaria kina celastrioides*	Always observe quarantine procedures before mixing newly acquired plants with other orchids in the farm or in the collection	
	Attacking the flowers			
	Moth or butterflies	*Orgvia postica*		
	Mites			
	Phalaenopsis mite	*Tenuipalpus pacificus*		
	Privet mite	*Brevipalpus ovobatus*		
Papaya	Sucking insects			
	Attacking the leaves			
	Oriental cotton stainer	*Dysdercus cingulatus*		Gabriel (1974)
	Armored scales			
	Coconut scale	*Aspidiotus destructor*		
	Florida red scale	*Chrysomphalus ficus*		
	Black scale	*Saissetia nigra*		
	Gray mealybug	*Ferrisia virgata*		
	Attacking the fruits			
	Coconut scale	*Aspidiotus destructor*		
	Chewing insects			
	Attacking the leaves			
	Peach moth	*Dichocrosis punctiferalis*		
	Tussock caterpillar	*Lymantria lunata*		
	Boring insects			
	Attacking the stems			
	Cerambycid beetle	*Dihammus vastator*		
	Mites			
	Rust mite	*Calocarus brionesae*	Dust infected plant with sulfur.	Espino and Cuevas (1976)
	Tenuipalpid mite	*Brevipalpus ovobatus*		Gabriel (1974)
	Tetranychid mite	*Tetranychus bimacuiatus*		Gavarra (1981)
		T. kanzawai		

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
Peanut	Sucking insects			
	Attacking the leaves			
	Bean aphid	*Aphis craccivora*		
	Leafhopper	*Empoasca biguttula*		
	Attacking the leaves and flowers			
	Stink bug	*Nezara viridual*		
	Chewing insects			
	Attacking the leaves			
	Common cutworm	*Spodoptera litura*		
	Coffee leaf folder	*Homona coffearia*		
	Corn semi-looper	*Chrysodeixis chalcites*		
	Sphinx moth	*Hippotion celerio*		
	Common katydid	*Phaneroptera furcifera*		
	Slant-faced grasshopper	*Atractomorpha psittacina*		
	Attacking the leaves, buds, flowers, and pods			
	Corn earworm	*Helicoverpa armigera armigera*		
	Attacking the stems and leaves			
	Tiger moth caterpillars	*Dasychira mendosa*		
	Attacking the roots and twigs			
	June beetle	*Leucopholis irrotata*		
	Boring insects			
	Attacking the stems			
	Corn borer	*Ostrinia furnacalis*		
	Attacking the flowers, buds, and pods			
	Bean lycaenid	*Catochrysops cnejus*		
	Mining insects attacking the leaves			

	Leafminer	*Stomopteryx subsecivella*		
	Bean leaf roller	*Lamprosema indicata*		
Pineapple	Sucking insects attacking the leaves			
	Armored scales			
	California red scale	*Aonidiella aurantii*		
	Coconut scale	*Aspidiotus destructor*		
	Fern scale	*Pinnaspis aspidistrae*		
	Pineapple mealybug	*Dysmicoccus brevipes*	Practice crop rotation in heavily infested areas.	Bondad, *et al.* (1977)
	Chewing insects attacking the roots			
	Root grubs	*Leucopholis irrorata*	Collect and destroy grubs.	Bondad, *et al.* (1977)
	Mites			
	Tenuipalpid mite	*Dolichotetranychus floridanus*		
Potato	Sucking insects			
	Attacking the leaves			
	Thrips	*Thrips tabaci*	Plow and harrow the field after harvest.	Verzola (1978)
			Use overhead and surface irrigation to reduce thrips population in the soil and the plants.	Balaoing, *et al.* (1979)
			Biological control: Use *Tapinoma philippinensis* to reduce thrips damage.	
	Cotton aphid	*Aphis gossypii*		
	Attacking the leaves and stems			
	Green peach aphid	*Myzus persicae*	Practice clean culture.	Verzola (1979) Balaoing, *et al.* (1979)

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
			Natural factors (windy, cool, and rainy environment) keep aphids below the level of economic damage.	
			Crops should be free of weeds since they form a frequent reservoir for renewed infestation.	
	Potato leafhoppers	*Empoasca fabae*		
	Chewing insects Attacking the leaves and stems			
	Common cutworms	*Spodoptera litura*	Periodic flooding of the soil during the first 30-45 days of the crop induces the larvae to leave their hiding places at daytime exposing them to predators.	Verzola (1978) Balaoing, *et al.* (1979)
	Black cutworms	*Agrotis ipsilon*		
	Attacking the roots, and tubers			
	Male cricket	*Gryllotalpa africana*	Use light traps. Flood the fields before planting.	Balaoing, *et al.* (1979)
			Harvest mature tubers as soon as possible.	
	Boring insects attacking the leaves, stems, and tubers			
	Potato tuber moth	*Phthorimaea operculella*	Reduce field damage by adequate hilling-up to cover the tubers thoroughly with soil.	Balaoing, *et al.* (1979)
	Mites			
	Spider mites	*Tetranychus* sp.		Gabriel (1974)
Rambutan	Sucking insects attacking the shoots and leaves			

	Rambutan bug	*Tessaratoma logicorne*		
	Cottony cushion mealybug	*Planococcus lilacinus*		
	Chewing insects attacking trunks and branches			
	Twig borer	*Niphonoclea albata* *N. capito*		
	Coffee carpenter moth	*Zeuzera coffeae*		
	Notodontid caterpillar	*Neostauropus alternus*		
	Boring insects attacking the fruits			
	Cacao pod borer	*Acrocercops cramerella*		
Ramie	Sucking insects attacking the stems and leaves			
	Green stink bug	*Nezara viridula*		Gabriel (1974)
	Gray mealybug	*Ferrisia virgata*		
	Leafhopper	*Chanithus* sp.		
	Chewing insects attacking leaves and stems			
	Weevil	*Metapocyrtus* sp.		
	Chrysomelid beetles	*Pnytorus* sp. *Monolepta bifasciata*		
	Corn earworm	*Helicoverpa armigera armigera*		
	Noctuid caterpillar	*Cocytodes caerulea*		
	Tortricid leaf roller	*Homona* sp.		
	Leaf rollers	*Sylepta derogata* *S. sabinusalis*		
	Lymantriid caterpillar	*Dasychira mendosa*		
Rice	Sucking insects attacking leaves (leaf sheath culm)			
	Brown planthopper	*Nilaparvata lugens*	Use resistant varieties: Biotype 1 — IR 26, IR 28,	IRRI (1979) IRRI (1978)

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
			IR 29, IR 32, IR 36, IR 38, IR 40, IR 42 Biotype 2 — IR 32, IR 36, IR 38, IR 40, IR 42 Biotype 3 — IR 26, IR 28, IR 30	IRRI (1977)
	White-back planthopper	*Sogatella furcifera*	Use intermediate resistant variety IR-38.	
	Green leafhopper	*Nephotettix virescens* *N. nigropictus*	Use resistant varieties: IR 5, IR 8, IR 20, IR 26, IR 28, IR 29, IR 30, IR 32, IR 36, IR 38, IR 40, IR 42, C4-63G.	IRRI (1979) IRRI (1978) IRRI (1977)
	Zigzag leafhopper	*Recilia dorsalis*		
	White rice leafhopper	*Cicadella spectra*		
	Chewing insects attacking leaves			
	Leaf folder	*Cnaphalocrosis medinalis*	Use resistant variety IR-5 and moderately resistant IR-8. Apply insecticides when 10% of the foliage has been eaten by the leaf folder.	IRRI (1979) IRRI (undated)
			Practice sanitation by removing graminaceous weeds which serve as alternate hosts.	
	Whorl maggot	*Hydrellia philippina*	Use resistant variety IR-40.	
			Use paddy water application of granules. Soil incorporation of a systemic insecticide is effective against maggot.	IRRI (undated)

			Apply insecticides within a few days after transplanting.	
	Boring insects attacking the stems			
	Pink stem borer	*Sesamia inferens*	Use moderately resistant varieties: IR 20, IR 28, IR 30, IR 32, IR 38, IR 42, C4-63G.	IRRI (1979)
	Striped stem borer	*Chilo suppressalis*	Use moderately resistant varieties: IR 20, IR 26, IR 28, IR 30, IR 32, IR 36, IR 38, IR 40, and IR 42.	Gabriel (1974)
	Yellow stem borer	*Tryporyza incertulas*		IRRI (undated)
	Dark-headed borer	*Chilo polychrysus*		
	White rice borer	*Tryporyza innotata*		IRRI (undated)
Rubber	Sucking insects attacking the leaves			
	Gray mealybug	*Ferrisia virgata*		
	Black scale	*Saissetia nigra*		
	Chewing insects			
	Attacking the trunks and branches			
	Bark borer	*Aeolesthes induta*		
	Shot-hole borers	*Dihammus vastator*		
		Crossotarsus sp.		
		Platypus jansoni		
	Attacking the leaves			
	Tussock caterpillar	*Orygia australis postica*		
Santol	Sucking insects			
	Attacking the shoots and leaves			
	Gray mealybug	*Ferrisia virgata*		Gabriel (1974)
	Soft scales			
	Hemispherical scale	*Saissetia coffeae*		
	Chinese wax scale	*Ceroplastes sinensis*		

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Armored scales			
	Boxwood scale	*Pinnaspis buxi*		
	Hoppers			
	Blue hopper	*Ricania speculum*		
	True hopper	*Gargara luconica*		
	Attacking the leaves			
	Eriophyid mite	*Eriophyes sandorici*		Raros (1978)
	Chewing insects			
	Attacking the stems trunks, and branches			
	Root grub	*Leucopholis irrorata*		
	Termites	*Neotermes* sp.		
	Twig borer	*Niphonoclea albata*		
	Shot-hole borer	*Platypus jansoni*		
	Attacking the leaves and shoots			
	Toy beetle	*Leucopholis irrorata*		
	Chrysomelid beetle	*Phytorus* sp.		
	Tussock caterpillar	*Lymantria lunata*		
	Atlas moth	*Attacus atlas*		
	Bagworm	*Kophene cupreo*		
	Attacking the fruits			
	Oriental fruit fly	*Dacus dorsalis*		
Solanaceous crops (eggplant, tomato, pepper)				
	Sucking insects			
	Attacking the leaves			
	Tree hopper	*Leptocentrus manilensis*		
	Cotton leaf hopper	*Empoasca biguttula*	Observe proper timing of planting to make crops more resistant at the onset of drier months when the pest is abundant.	Esguerra and Gabriel (1969)

	Attacking the leaves and branches			
	Coreid bug	*Acanthocoris scabrator*		Esguerra and Gabriel (1969)
	Chewing insects attacking the leaves			
	Pepper bagworm	*Eumeta fuscescens*		
	Tussock moth caterpillar	*Lymantria lunata*		
	Attacking the fruit, flowers, and leaves			
	Flea beetle	*Psylloides balyi*	Practice crop rotation.	
			Destroy weeds and wild plants that serve as hosts.	Esguerra and Gabriel (1969)
		P. splendida		
	Lady beetle	*Epilachna pusillanima philippinensis*	Use natural enemies: *Pedobius spilachnae; Tenodera* sp.	Esguerra and Gabriel (1969)
		Coleoptera coccinellidae		
	Tomato fruitworm	*Helicoverpa armigera armigera*	Practice crop rotation.	Esguerra and
			Do not use susceptible plants in succession.	Gabriel (1969)
Sorghum	Sucking insects			
	Attacking the leaves			
	Aphids	*Rhopalosiphum maidis*		
		Longiunguis sacchari		
		Macrosiphum miscanthis		
		M. graminis		
	Black leafhopper	*Ricania speculum*		
	Corn leafhopper	*Peregrinus maidis*		
	Plant hopper	*Perkinsiella bakeri*		
	Grass derbid	*Proutista moesta*		
	Attacking the roots			
	Root aphids	*Geoica lucifuga*		
		Tetranuera nigriabdominalis		

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Chewing insects			
	Attacking the leaves			
	Cutworm	*Spodoptera litura*		Gabriel (1974)
	Grasshoppers; katydids			
	Long-horned grasshopper	*Phaneroptera furcifera*		
	Short-horned grasshopper	*Ailopus tamulus*		
		Atractomorpha psittacina		
		Gastrimargus marmoratus transversus		
		Trilophidia annulata		
	Migratory locust	*Locusta migratoria manilensis*		
	Rice armyworm	*Spodoptera mauritia*		
	Semi-looper	*Chrysodeixis chalicit* sp.		
	Attacking the stems			
	Crickets	*Teleogryllus testaceus*		
		Gryllus simaculatus		
	Attacking the grains or head and panicles			
	Nitidulid beetle	*Carpophilus mutilatus*		
	Sorghum headworm	*Helicoverpa armigera*		
	Sorghum webworm	Unidentified		
	Boring insects			
	Attacking the stems			
	Corn borer	*Ostrinia furnacalis*		
	Attacking the seedlings			
	Corn seedling maggot	*Atherigona oryzae*		
Soursop	Sucking insects attacking the leaves			
	Lace bug	*Stephanitis typicus*		
	Mango leafhopper	*Idioscopus clypealis*		

Mealybugs			
Gray mealybug	*Ferrisia virgata*		
Cottony cushion mealybug	*Planococcus lilacinus*		
Aphids	*Toxoptera aurantii*		
Giant coccids	*Drosicha townsendi*		
	Icarya seychellarum		
Armored scales			
Cassia bark scale	*Clavaspis herculeana*		
Coconut scale	*Aspidiotus destructor*		
Florida red scale	*Chrysophalus ficus*		
Soft scales			
Black scale	*Saissetia nigra*		
Hemispherical scale	*Saissetia coffeae*		
Olive scale	*Saissetia oleae*		
Chewing insects			
Attacking the leaves and shoots			
Papilionid caterpillar	*Graphium agamemnon*		
Peach moth	*Dichocrosis punctiferalis*		
Pyraustid caterpillar	*Sylepta sabinusalis*		
Nuctuid caterpillar	*Autoba grisescens*		
Atlas moth	*Attacus atlas*		
Tiger moth	*Diacrisia metarhoda*		
Bagworm	*Eumeta fuscescens*		
Attacking the fruits			
Atis moth borer	*Heterographis bengalella*	Collect and burn infected fruits.	Coronel (1977)
Fruit flies			
Oriental fruit fly	*Dacus dorsalis*		
Melon fruit fly	*Dacus cucurbitae*		
Attacking the roots			
Root grubs	*Anomala* spp.		
	Leucopholis irrorata		
Boring insect attacking the stems			
Coffee carpenter moth	*Zeuzera coffeae*	Collect and burn infected twigs.	Coronel (1977) Gabriel (1974)

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
Sugarcane	Sucking insects			
	Attacking the leaves			
	Leafhoppers	*Eumetopina flavipes* *Perkinsiella vastatrix* *Proutista moesta*		
	Wooly aphid	*Ceratovacuna lanigera*	Biological control: Use giant body beetle (*Synonycha grandis*). Other lady beetles, syrphid fly, and teneid moth are predators that control the aphid.	Reyes (1976) Recuenco (1967) Tabayoyong (1958)
	Attacking the buds and underground parts			
	Scale insects	*Lepidosaphes* sp. *Aulacaspis tegalensis*		
	Burrower bug	*Macroscytus transversus* *Stibaropus callidus* *S. maginus*		
	Attacking the stems			
	Pink mealybug	*Trionymus sacchari*	Natural enemies: *Aspergillus* sp. (a green fungus) — Three species of minute wasps; *Anagyrus dactylopii* and two unidentified ones. — Two lady beetles: *Cryptogenus orbiculus* and *Pullus* sp. — Earwings: *Proreus simulans* and *Chelisoches morio*. Cultural methods: Remove and dispose old cane stubbles and stems in the field before replanting.	Reyes (1976) Recuenco (1967) Tabayoyong (1958)

		Weed out 'tigbao' and other grasses from the borders to eliminate the alternate hosts.	
Chewing insects			
Attacking the leaves			
Leaf eating caterpillar	*Dinara combusta*		
Oriental migratory locust	*Locusta migratoria manilensis*	Biological control: Use the most important enemies of locust: Philippine shrike, Cattle egret, kingfishers, curlew (*Numerius variegallus*), garden plover (*Charadius fulvus*), Indian roller (*Eurystomus orientalis*), and bee eaters.	Reyes (1976) Recuenco (1967) Tabayoyong (1958)
Attacking the underground parts (roots)			
Male cricket	*Gryllotalpa africana*		
Termites			
	Coptotermes vastator	Repeated tilling of the soil drives the termites away.	Reyes (1976) Recuenco (1967) Tabayoyong (1958)
White grubs	*Leucopholis irrorata*	Plant deep-rooted legumes to reduce the population of grubs in the soil. Natural enemies: Eggs and newly hatched larvae are subject to attacks of ants and certain species of mites. A number of wasps parasitize the white grubs. The most important of these	

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
			parasites are: *Campsomeris marginella* spp. *modesta*; *Tiphia segregeta*.	
	Attacking the stalks and young canes			
	Sugarcane armyworm	*Cirphis loreyi*	Natural control: The bird 'Martinez' preys on the insect. Frogs and toads are observed to attack caterpillars and pupae in the soil.	Reyes (1976) Recuenco (1967) Tabayoyong (1958)
	Boring insects attacking the stalks and young canes			
	Sugarcane borer	*Sesamia inferens* *Orgyroplace schistaceana* *Diatraea infuscatella* *Eucosma schistaceana* *Scirpophaea nivella*	Biological control: Use wasp parasites: *Trichogramma australicum*; *T. japonicum*.	Reyes (1976) Recuenco (1967) Tabayoyong (1958)
	Stem boring caterpillar	*Eucosma schiztaceana*		
	Chewing and boring insects attacking the shoots, stalks, and buds			
	Five-striped borer	*Chilo infuscatellus*	These borers are found in alternate hosts. Clean the field and prune the crop to reduce borer damage. Biological control: Use *Trichogramma* parasites.	Reyes (1976) Recuenco (1967) Tabayoyong (1958)
	Gray borer	*Tetramoera schistaceana*	Use the *Trichogramma* 4-8 times at five strips/ha per release. Do the first release during the 4th week after planting. Ratoon early (about Sept-Oct.) when it is rainy.	

			Eliminate weeds that grow profusely along the edges of cane fields such as *Saccharum spontaneum, Cyperus rotundus, Panicum maximum,* Napier grass.	
	Pinehole beetle	*Xyleborus affinis*		
	Pink borer	*Sesamia inferens*	Remove 'tigbao' and other grasses to eliminate alternate hosts.	Reyes (1976) Recuenco (1967) Tabayoyong (1958)
	Reddish-brown weevil	*Trochorrhopalus strangulatus*		
	Mites	*Oligonychus orthius* *Tetranychus truncatus* *T. kanzawai*		
Sunflower	Chewing insects			
	Attacking the leaves			
	Katydid	*Phaneroptera furcifera*		Lopez, Guantes, and Al-Azawi (1972)
	Cutworm	*Chrysodeixis chalcites*		
	Tussock moth caterpillar	*Orygia postica* *Euproctis innonata*		
	Cotton leafworm	*Spodoptera litura*		
	Attacking the leaves and flowers			
	Leaf folder	*Homona* sp.		
	Chewing and boring insects			
	Attacking the bolls			
	Cotton bollworm	*Helicoverpa armigera*		
	Boring insects			
	Attacking the stems			
	Corn stem borer	*Ostrinia furnacalis* Guenee		
Sweet Potato	Sucking insects attacking the leaves			

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Sweet potato bug	*Physomerus grossipes*		
	Coreid bug	*Anoplocnemis phasiana*		
	Lygaeid bug	*Malcus flavidipes*		
	Melon aphid	*Aphis gossypii*		
	Gray mealybug	*Ferrisia virgata*		
	White fly	*Bemisia tabaci*	Natural enemies: *Prospaltella clypealis* and *Prospaltella* sp.	
	Chewing insects attacking the roots and tubers			
	Root grubs	*Anomala* sp. *Apogonia* sp. *Leucopholis irrorata*	Control the grubs using trap pits filled with leaves. Examine the pits at regular intervals, every month during the rainy season.	Frohlich and Rodewald (1970)
	Sweet potato weevil	*Cylas formicarius formicarius*	Practice crop rotation. Destroy damaged tuberous roots.	Frohlich and Rodewald (1970)
	Oriental migratory locusts	*Locusta migratoria manilensis*		
	Short-horned grasshopper	*Atractomorpha psittacina* *Oxya chinensis*		
	Katydid or long-horned grasshopper	*Phaneroptera furcifera*		
	Chrysomelid beetles	*Phytorus* spp. *Prionispa* sp.		
	Tortoise shell beetle	*Aspidomorpha fusconotata*	Natural enemies: Shalcid parasite *Tetrastichus* sp., *Rhizoglyphus* sp., spider, red ants.	Esguerra and Gabriel (1969)
		A. miliares *Cassida circumdata* *Laccoptera philippinensis* *L. tredecimpunctata*		

	Cutworm and armyworm	*Pseudaletia separata* *Spodoptera litura*		
	Sphinx moth or hornworm	*Acherontia lachesis* *Agrius convolvuli*		
	Attacking the leaves			
	Tussock moth caterpillar	*Euchromia horsfieldi*	Remove wild species of *Ipomoea*.	
	Sweet potato plume moth	*Aciptilia viveodactyla*		
	Mites	*Tetranychus truncatus*		Gabriel (1974)
Taro	Sucking insects attacking the leaves			
	Melon aphid	*Aphis gossypii*		
	Banana aphid	*Pentalonia nigronervosa*		
	Gabi planthopper	*Terophagus proserpina* *Megameles proserpina*		
	Coconut scale	*Aspidiotus destructor*		
	Pineapple mealybug	*Dysmicoccus brevipes*		
	Cottony cushior mealybug	*Planococcus lilacinus*		
	Chewing insects attacking the leaves			
	Cutworm	*Spodoptera litura*		
	Gabi hornworm	*Hippotion celerio*		
	Green sphinx moth	*Rhyncolaba acteus*		
	Sweet potato hornworm	*Agrius convolvuli* *Protoparce convolvuli*		
	Gabi skipper	*Tagiades japetus titus*		
	Corn silk beetle	*Monolepta bifasciata*		
	Mites	*Schizotetranychus techrius*		
Tobacco	Sucking insects			
	Attacking the leaves			
	Tobacco thrips	*Thrips tabaci*		
	Small green bug	*Cyrtopeltis tenuis*		
	Green stink bug	*Nezara viridula*		
	Green peach aphid	*Myzus persicae*		
	Gray mealybug	*Ferrisia tabaci*		
	White fly	*Bemisia tabaci*		

Table 13. (Continued)

Crops	Common Name of Pests	Scientific Name of Pests	Control Measures	References
	Attacking the stems			
	Hemispherical scale	*Saissetia coffeae*		
	Black scale	*Saissetia nigra*		
	Attacking the roots			
	Burrower bug	*Geotomus pygmaeus*		
	Chewing insects			
	Attacking the leaves			
	Green tree cricket	*Oecanthus indicus*		
	Short-horned grasshopper	*Atractomorpha psittacina*		
	Long-horned grasshopper	*Phaneroptera furcifera*		
	Tobacco budworm	*Heliceverpa armigera*		
	Common cutworm	*H. assulta assulta*		
	Greasy cutworm	*Agrotis segetum*		
	Black cutworm	*A. ipsilon*		
	Corn semi-looper	*Chrysodeixis chalcites*		
	Pyraustid caterpillar	*Pasara hipponalis*		
	Tiger moth	*Diacrisia metarhoda*		
	Taeneid caterpillar	*Setomorpha rutella*		
	Tobacco hornworm	*Acherontia lachesis*		
	Attacking the seeds in the seedbed			
	Red fire ant	*Solenopsis geminata rufa*		
	Cigarette beetle	*Lasioderma semicorne*		
	Drugstore beetle	*Stegobium paniceum*		
	Tobacco moth	*Ephestia elutella*		
	Taeniid caterpillar	*Setomorpha rutella*		
	Attacking the roots			
	Mole cricket	*Gryllotalpa africana*		
	Chewing or boring insects attacking the stems			
	Tenebreonid beetle	*Gonocephalum aequatoriale*		
	Tobacco stem borer	*Phthorimaea heliopa*		

Winged bean	Sucking insect attacking the flower buds and pods		
	Bean aphid	*Aphis craccivora*	Quebral, *et al.* (1980)
	Boring insect attacking the flower buds and pods		
	Bean pod borer	*Maruca testulalis*	
	Mining insect attacking the leaves		
	Bean fly	*Ophiomyia phaseoli*	
	Mite		
	Spider mite	*Tetranychus* sp.	
Yam (lesser yam, greater yam)	Sucking insects attacking the leaves		
	Ubi scale	*Aspidiella hartii*	Gabriel (1974)
	Coconut scale	*Aspidiotus destructor*	
	Chewing insect attacking the leaves		
	Corn silk beetle	*Monolepta bifasciata*	

Table 14. Chemical control of insect and mite pests of crops grown in the Philippines

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Insects/Mites Controlled
Acephate	Orthene 75 SP/400 LC	Rice	Green leafhopper Brown planthopper White-back planthopper Zigzag planthopper
Aldrin	Aldrex Aldrin 40 EC/40 WP Aldrite	Rubber	Termite Cockchafer grub
Azinphos-ethyl	Azinos 40 EC WB - Azinphos Azinphos ethyl Cotnion Gusathion A	Mango Pineapple Rice	Mango hopper Coconut scale Green leafhopper Pink stem borer Rice stem borer Leaf folder Rice caseworm Rice bug Armyworm Cutworm Looper
BPMC	Baycarb 50 EC Hopcin 4 G/50 EC Osbac Metcarb Shellcarb	Rice	Green leafhopper Brown planthopper White-back planthopper Zigzag planthopper
Carbaryl	Carbin 85 S/85 E Dicarbon 85 WP Mirvin 85 WP Ravyon WP Tercyl 85 WP Vetox 85	Corn Grapes Mango Orchid Rice	White grub Corn semi-looper Corn borer Corn earworm Grape berry moth Cutworm Sphinx moth Bagworm Leafhopper Grasshopper Mango hopper Mango tip borer Mango twig borer Oriental fly Banded leafhopper Leafhopper blossom Mango leafhopper Grasshopper Katydid Green leafhopper Leaf folder

Table 14. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Insects/Mites Controlled
			Rice caseworm
			Rice bug
			Armyworm
			Cutworm
			Looper
		Rubber	Caterpillar
			Leaf-eating caterpillar
	Sevin 50 WP/85 SP	Beans	Bean pyralid
			Bean pod borer
			Tomato fruitworm
		Tobacco	Cutworm
			Corn semi-looper
Carbaryl		Tobacco	Grasshopper
			Tobacco budworm
			Green soldier bug
			Tobacco thrip
Carbaryl + BHC	Sevidol 4/4 G	Rice	Green leafhopper
			Brown leafhopper
			Stem borer
Carbofuran	Furadan 5 G/3G	Beans	Bean fly
		Corn	White grub
			Corn seedling maggot
			Armyworm
			Cutworm
			Corn borer
			Corn earworm
			June beetle, bean aphid
		Peanut	Leafhopper
			Aphids
			Leaf miner
		Potato	Aphids
			Thrips
		Rice	Green leafhopper
			Rice stem borer
			Pink stem borer
			Brown planthopper
			White-back planthopper
			Zigzag planthopper
			Gall midge
		Sorghum	Shoot fly
		Winged bean	Beanfly
Carbophonothion	Endyl 40 EC	Citrus	Mites (red spider mites)
	Lethax 30 EC		
	Trithion 4 E	Rice	Brown planthopper
			Green leafhopper

Table 14. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Insects/Mites Controlled
			White-back planthopper
			Zigzag planthopper
Chlorpyrifos	Dursban	Cacao	Capsid
	Dursban Xylena		Mosquito bug
	Fradex		Curculionid beetle
	Lorsban		Cacao shot-hole borer
			Cacao pod borer
		Corn	Armyworm
			Cutworm
			Corn borer
			Corn earworm
		Rice	Rice stem borer
			Green leafhopper
			Stem borer
			Pink stem borer
			Leaf folder
			Rice caseworm
			Rice bug
			Armyworm
			Cutworm
			Looper
Chlorpyrifos + BPMC	Brodan	Rice	White-back planthopper
			Green leafhopper
			Stem borer
			Pink stem borer
			Leaf folder
			Rice caseworm
			Rice bug
			Armyworm
			Cutworm
			Zigzag planthopper
			Looper
			Brown planthopper
Diazinon	Basudin 21 EC/90 SC	Beans	Bean fly
	Dianol		Black cutworm
	Diuzol		Bean pyralid
	Diagron		Bean pod borer
			Tomato fruit worm
			Aphids
			Green soldier bug
		Others	Jumping plant lice or citrus psylla
		Grapes	Scale insects
			Mealybug
			Vinegar fly
			Grape berry moth

Table 14. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Insects/Mites Controlled
			Leafhopper
			Grasshopper
			Fruit fly
		Mango	Mango tip borer
			Mango twig borer
			Mango hopper
			Scale insects
			Mealybug
			Leafhopper blossom
			Banded leafhopper
			Mango leafhopper
		Mungo	Bean fly
			Leaf folder
			Leaf miner
			Leafhopper
			Flea beetle
			Common cutworm
			Earworms
			Corn semi-looper
			Aphids
		Peanut	Common cutworm
			Corn earworm
			Corn semi-looper
			Leaf folder
			Leaf roller
		Pineapple	Coconut scale
			Fern scale
			California red scale
		Rice	Rice stem borer
			Caseworm
			Leaf folder
		Rice	Gall midge
			Stem borer
			Pink stem borer
			Rice bug
			Armyworm
			Cutworm
			Loopers
			Green leafhopper
			Brown planthopper
			White-back planthopper
			Zigzag planthopper
			Whorl maggot
		Soybean	Bean fly
			Leaf miner

Table 14. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Insects/Mites Controlled
			Leaf aphids Common cutworm
		Sorghum	Shoot fly Armyworm
		Winged bean	Bean fly Bean pod borer
Dicrotophos	Bidrin 20 EC/30 EC	Cotton	Cotton bollworm
Dieldrin	Dieldrex Dieldrin	Rubber	Termites Yellow tea mites Thrips Grasshoppers
Dimethoate	Perfecthin EC Rogor L-40 Roxion Cygon	Bean	Pea leafminer
		Orchid	Thrips Mealybug Scale insects *Orgyia postica* Other moths
		Sorghum	Shoot fly Aphids
Dioxathion	Delmar 4 EC	Grapes	Mites
Endosulfan	Thiodan Endox Thiomex Endosulfan WB Endosulfan 35 EC	Cacao	Capsid Mosquito bugs Curculionid beetle Cacao shot-hole borer Cacao pod borer
		Citrus	Jumping plant lice or citrus psylla
		Corn	Corn seedling maggots Armyworm Cutworm Corn borer Corn earworm True armyworm
		Corn	Black African armyworm Corn semi-looper
		Cotton	Cotton bollworm
		Grapes	Mites Scale insects Mealybug

Table 14. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Insects/Mites Controlled
			Sphinx moth Grape flea beetle Leafhopper
		Mango	Mango seed borer
		Rice	Rice bug Stem borer Pink stem borer Green leafhopper
		Rubber	Yellow tea mite Thrips
Endrin	Endrin	Sugarcane	Wooly aphid Sugarcane armyworm Pink mealybug Sugarcane borer
EPN	EPN	Citrus	Leaf miner Rind borer Green bug Bark borer Purple scale Snow scale Glower scale Green scale
Fenitrothion	Agrothin Sumithion	Rice	Green leafhopper Caseworm Leaf folder
		Tomato	Tomato fruitworm Aphids
Fenthion	Lebaycid	Rice	Green leafhopper Rice stem borer
Gamma BHC	Lindane	Orchid	Grasshopper Katydid Phalaenopsis lycaenid Beetles Grubs Butterfly, moths
		Rice	Stem borers (except pink stem borers)
		Rubber	Crickets
Gamma BHC + MIPC	Dolmix 6/3 G Gamma Hytox 6/4G	Rice	Green leafhopper Brown planthopper Stem borers
Heptachlor	Planters Heptachlor 3 E/2 E	Abaca	Corm weevil

Table 14. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Insects/Mites Controlled
	Heptachlor		
Malathion	Agri Malathion Hoechst Malathion Planters Malathion Turbair Malathion WB Malathion E 57	Beans	Bean fly Bean pyralid Bean pod borer Aphids Green soldier bug Bean weevil
	Malathion E-57/ULV	Cacao	Capsid Mosquito bugs Curculionid beetle Cacao shot-hole borer Cacao pod borer
		Cotton	Grasshoppers
		Mungo	Bean fly Leaf folder Leafhopper Leaf miner Flea beetle Common cutworm Earworm Corn semi-looper Aphids
		Orchid	*Orgyia postica* Other moths
		Peanut	Leafhopper Aphids Leaf miner Common cutworm Corn earworm Corn semi-looper Leaf folder/roller
		Rice	Rice bug
		Rubber	Grasshopper
		Sorghum	Aphids Sorghum headworm Sorghum webworm Corn earworm
		Soybean	Bean fly Leaf miner Bean aphids Green stink bug
		Tobacco	Grasshopper Aphids Plant lice

Table 14. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Insects/Mites Controlled
			Green soldier bug Tobacco thrips Black scale
		Winged bean	Bean fly Bean pod borer
Metalkamate	Bux 3 G/300 EC	Rice	Brown planthopper
Methamidophos	Agri Hamidop Tamaron	Cabbage	Diamond-back moth Cabbage moth Common cutworm Aphids
		Cauliflower	Aphids
Methomyl	Lannate	Beans	Bean pyralid Bean pod borer Tomato fruitworm
		Corn	Armyworm Cutworm Corn borer Semi-looper
		Sorghum	Sorghum headworm Sorghum webworm Earworm
		Tobacco	Tobacco budworm (except for shade grown tobacco)
		Tomato	Tomato fruitworm
Methyl-Parathion	Folidol Meptox Methyl Fosferno Parapest 19 Pathion Parathion M-50	Cotton	Grasshopper
		Pineapple	Pineapple mealybug Scale insects Coconut scale California red scale Fern scale
Mevinphos	Phosdrin	Cabbage	Diamond-back moth Cabbage moth Common cutworm Aphids Caterpillar
		Onion	Thrips
Monocrotrophos	Azodrin 168 Azodrin 202 E Azodrin 500	Beans	Bean fly Tomato fruitworm Pea leaf miner
	Plantdrin	Cotton	Cotton bollworm

Table 14. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Insects/Mites Controlled
	Monocron Nuvacron	Mungo	Bean fly Leaf folder Leafhopper Leaf miner Flea beetle Common cutworm Earworm Corn semi-looper Aphids Mites
		Orchid	Thrips Mealybug Scale insects
		Peanut	Leafhopper Aphids Leaf miner Common cutworm Corn earworm Corn semi-looper Leaf folder/roller
		Rice	Green leafhopper Rice stem borer Caseworm Leaf folder Rice whorl maggot Brown leafhopper White-back planthopper Zigzag planthopper Pink planthopper Rice bug Armyworm Cutworm Loopers
		Soybean	Bean fly Leaf miner Bean aphids Leaf folder
		Winged bean	Bean fly Bean pod borer Aphids (bean)
MTMC	Tsumacide	Rice	Green leafhopper Brown planthopper White-back planthopper Zigzag planthopper

Table 14. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Insects/Mites Controlled
			Rice bug
Phosphamidon	Dimecron 50 SCW Dimecron 100 SCW	Rice	Stem borer Pink stem borer
Tetrachlorvinphos	Gardona 75 WP	Tomato	Tomato fruitworm
Triazophos	Hostathion	Cabbage	Diamond-back moth Cabbage moth
Trichlorphon	Dipterex 95 SP	Rubber	Caterpillar
		Tobacco	Corn semi-looper Cutworm Mole cricket

Table 15. Host range of insect and mite pests in the Philippines

Insect/Mite Pests	Crops Affected
Boring Insects	
Bean lycaenid	
Catochrysops cnejus	Peanut
Bean pyralid	
Maruca testulalis	Beans, winged bean
Beetles	
Dihammus vastator	Papaya
Gonocephalum acquatoriale[a]	Tobacco
Pachyrynchus monoliferus[a]	Cacao
Xyleborus affinis[a]	Sugarcane
Borers	
Acrocercops cramerella[b]	Cacao, rambutan
Apomecyna histrio	Cucurbits
A. neglecta	Cucurbits
Chilo infuscatellus[a]	Rice
C. suppressalis	Rice
Chlumetia transversa	Mango
Coelosterna pulchellator	Lanzones
Dihammus sp.	Lanzones
Etiella zinckenella	Beans
Manilabaris cucurbitae	Cucurbits

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
Maruca testulalis	Winged bean
Niphonoclea albata[a]	Cashew, kenaf, lanzones, mango, rambutan, santol
N. capito	Cashew, lanzones, rambutan
Noorda albizonalis[a]	Mango
Ostrina furnacalis	Corn, peanut, sorghum
Phthorimaea heliopa	Tobacco
Scirpophaga nivella	Sugarcane
Sesamia inferens[a]	Rice, sugarcane
Teiramoera schistaceana[a]	Sugarcane
Thestus sp.	Lanzones
Tryporyza incertulas	Rice
Xyleborus spp.[a]	Cacao
Corn seedling maggot	
Atherizona oryzae	Corn, sorghum
Leaf miner	
Stomopteryx subsecivella	Peanut
Moths	
Dichocrosis punctiferalis[a]	Corn, durian, guava, papaya, soursop
Orgyia australis postica[a]	Cacao
Phthorimaea operculella	Potato
Zeuzera coffeae[a]	Breadfruit, coffee, durian, jackfruit, kenaf, okra, rambutan, soursop
Pink aphid	
Sesamia inferens	Corn
Weevils	
Sitophilus oryzae	Cashew
Trochorrhopalus strangulatus	Sugarcane
Chewing Insects	
Armyworms	
Agrotis segetum	Cucurbits
Cirphis loreyi	Sugarcane
Pseudaletia separata	Corn, cucurbits, sweet potato
Spodoptera exempta	Corn
S. litura	Cucurbits, sweet potato
S. mauritia	Corn, sorghum

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
Bagworms	
Eumeta fuscescens	Grapes, lanzones, soursop
E. sp.	Solanaceous crops
E. variegata	Guava
Kophene copreo	Santol
Beetles	
Adoretus ranunculus albizonalis[a]	Lanzones
A. sp.	Grapes
Amphimela meroorum	Kenaf
Aspidomorpha fusconotata	Sweet potato
A. miliaris	Sweet potato
Aulacophora cottigarensis	Cucurbits
A. flavomarginata	Cucurbits
A. similis	Cucurbits
Carpophilus mutilatus	Sorghum
Cassida circumdata	Sweet potato
Epilachna philippinensis	Cucurbits, kenaf, solanaceous crops
Laccoptera philippinensis	Sweet potato
L. tredecimpunctata	Sweet potato
Lasioderma sericorne	Garlic, onion, tobacco
Leucopholis irrorata	Corn, peanut
Luperomorpha sericornis	Solanaceous crops
Mecopus sp.	Lanzones
Monolepta bifasciata	Cassava, corn, kenaf, okra, ramie, taro, yams
Nisotra gemella	Kenaf, okra
Oryctes rhinoceros	Coconut
Philicoptus iliganus	Banana
Phyllotreta sp.	Kenaf
Phytorus sp.	Guava, lanzones, ramie, santol, sweet potato
Plesispa sp.	Coconut
Prionispa sp.	Sweet potato
Psylliodes brettinghami	Solanaceous crops
P. punctifrons	Solanaceous crops
Stegobium paniceum	Tobacco
Xyleborus perforans	Coconut
Bollworms	
Earias fabia[c]	Kenaf, okra

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
Helicoverpa armigera	Cotton, sunflower
Pectinophora gossypiella	Kenaf
Borers	
Aeolesthes induta	Rubber
Agrilus occipitalis	Citrus
Batocera rubus	Breadfruit, jackfruit
Belionata sp.	Citrus
Chrysocroa fulminans	Citrus
Cossus sp.	Lanzones
Crossotarsus sp.	Rubber
Dihammus vastator	Cassava, rubber
Eretmocera sp.	Lanzones
Ereunitis sp.	Lanzones
Hypothenemus hampei	Coffee
H. psidii	Guava
Mimegralla coeruleifrons	Ginger
Platypus jansoni	Rubber
Prasinoxena sp.	Lanzones
Prays endolemma	Citrus
Xylosandrus compactus	Coffee
Xyleborus sp.	Lanzones
Budworm	
Helicoverpa armigera armigera	Tobacco
Cabbage worm	
Crocidolomia binotalis	Crucifers, cucurbits
Cabbage butterfly	
Philosamia ricini	Mulberry
Castor silkworm	
Pieris canidia	Crucifers
Caterpillars	
Autoba grisescens	Guava, soursop
Catochrysops cnejus	Guava
Cheromellia comatrensi	Coconut
Cocytodes caerulea	Ramie
Dasychira mendosa	Cucurbits, peanut, ramie
Diaphania ceasalis	Pyraustid caterpillar
D. indica	Kenaf
Dinara combusta	Corn, sugarcane

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
Euchromia horsfieldi	Sweet potato
Euproctis innotata	Sunflower
E. varians	Kenaf
Graphium agamemnon agamemnon	Soursop
Hyposidra sp.	Lanzones
H. talaca	Kenaf, okra
Locusta migratoria manilensis	Coconut
Lymantria lunata	Guava, papaya, santol, solanaceous crops
L. sp.	Lanzones
Metanastria hyrtaca	Guava, papaya, santol, solanaceous crops
Neostauropus alternus	Rambutan
Orgyia postica	Sunflower
O. australis postica	Rubber
Parasa lepida	Coconut, kenaf, okra
Psara hipponalis	Tobacco
Setomorpha rutella	Tobacco
Suana concolor	Okra
Strepsicrates ejectana	Guava
Sylepta derogata	Kenaf, okra
S. sabinusalis	Soursop
Thosea sinensis	Abaca, coconut, guava, lanzones
Coconut leaf miner	
Promecotheca cumingii	Coconut
Crickets	
Gryllotalpa africana	Potato, sugarcane
Gryllus bimaculatus	Corn, sorghum
Oecanthus indicus	Tobacco
Teleogryllus testaceus	Corn, sorghum
Cutworms	
Agrotis ipsilon	Corn, garlic, onion, potato
A. segentum	Cucurbits, tobacco
Anomis erosa	Cotton, jute
A. sabulifera	Kenaf
Calograma festiva	Garlic, onion
Chrysodeixis chalcites	Sunflower
Leucania loreyi	Corn
Mocis frugalis	Corn

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
Pseudaletis separata	Cucurbits, sweet potato
Spodoptera exigua	Garlic, onion
S. litura	Celery, cucurbits, garlic, onion, peanut, potato, sorghum, sweet potato, taro
Xanthodes transversa	Kenaf, okra
Earworm	
Helicoverpa armigera	Corn, crucifers, cucurbits, kenaf, peanut, sorghum
Fruit flies	
Dacus cucurbitae[a]	Cucurbits, guava, mango, soursop
D. dorsalis[a]	Avocado, guava, mango, santol
D. hageni	Cucurbits
D. mundus	Cucurbits
D. umbrosus	Breadfruit, jackfruit
Drosophila ananasae	Guava
Fruitworm	
Helicoverpa armigera armigera	Garlic, onion, tomato
Gabi skipper	
Tagiades japetus titus	Taro
Grape skeletonizer	
Unidentified *zygaenid*	Grapes
Grasshoppers/locusts	
Ailopus tamulus	Corn, sorghum
Atractomorpha psittacina	Corn, peanut, sorghum, sweet potato, tobacco
Euconocephalus varius	Corn
Gastrimargus marmoratus transversus	Corn, sorghum
Locusta migratoria manilensis	Coconut, corn, sorghum, sugarcane, sweet potato
Melicodes tenebrosa tenebrosa	Corn
Oxya chinensis	Sweet potato
Phaneroptera furcifera	Kenaf, orchids, sorghum, sweet potato, tobacco
Grubs	
Adoretus spp.	Corn
Anomala humeralis	Cucurbits
A. sp.	Breadfruit, corn, jackfruit, sweet potato
Apogonia sp.	Sweet potato
Holotrichia sp.	Corn
Leucopholis irrorata	Breadfruit, corn, cucurbits, jackfruit,

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
	kenaf, maguey, orchids, pineapple, santol, sisal, sugarcane, sweet potato
Leaf folders/leaf rollers	
Homona coffearia	Beans, garlic, onion, peanut
H. spp.	Lanzones
Cnaphalocrosis medinalis	Rice
Diaphania indica	Cucurbits
Hymenia recurvalis	Cucurbits
Lamprosema indicata	Beans, peanut
Parnara guttatus mangala	Corn
Sylepta derogata	Cotton, ramie
S. salvinusalis	Ramie
Moths	
Acherontia lachesus	Sweet potato
Aciptilia niveodactyla	Sweet potato
Agrius convolvuli	Grapes, sweet potato, taro
Anomis erosa	Kenaf
Attacus atlas	Guava, lanzones, santol, soursop
Batracehedra arenosella	Coconut
Cosmophila erosa	Okra
Diarisia metarhoda	Soursop, tobacco
Ephestia elutella	Garlic, onion, tobacco
Heterographis bengalella	Soursop
Hippotion celerio	Peanut, taro
Othreis fullonia	Guava
Plutella xylostella	Crucifers
Prasinoxena sp.	Lanzones
Rhyncolaba acteus	Taro
Sitotroga cerealella	Garlic, onion
Tiratheba sp.	Coconut
Red fire ant	
Solenopsis geminata rufa[b]	Kenaf, lanzones, okra, tobacco
Semi-loopers	
Anadevida peponis	Cucurbits
Anomis sabulifera	Okra
Chrysodeixis chalcites	Corn, peanut, sorghum, tobacco
Termites	
Coptotermes vastator	Sugarcane

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
Macrotermes gilvus	Cassava, lanzones
Nasutitermes luzonicus	Breadfruit, jackfruit, lanzones
Neotermes spp.	Guava, santol
Weevils	
Araecerus fasciculatus	Coffee
Cosmopolites sordidus	Abaca, banana
Diocalandra frumenti	Coconut
Mecopus bispinosus	Mulberry
M. hopei	Mulberry
Metapocyrtus sp.	Ramie
Rhynchophorus schach	Coconut
Whorl Maggot	
Hydrellia philippina	Rice
Sucking Insects	
Aphids	
Aphis craccivora	Cucurbits (bitter gourd, bottle gourd, chayote, cucumber, dish rag gourd, muskmelon, squash, watermelon, wax gourd), peanut, winged bean
A. gossypii	Cucurbits, guava, kenaf, potato, sweet potato, taro
Ceratovacrana lanigera	Sugarcane
Geoica lucifuga	Corn, sorghum
Greenidea formosona	Guava
Myzus persicae	Celery, crucifers (cabbage, cauliflower, pechay, radish), cucurbits, potato, tobacco
Pentalonia nigronervosa	Abaca, taro
Rhopalosiphum maidis	Corn, sorghum
Tetraneura nigriabdominalis	Corn, sorghum
Toxoptera aurantii	Cucurbits, guayabano, lanzones
T. citricida	Cucurbits
Armored Scales	
Aonidiella aurantii	Breadfruit, jackfruit, maguey, mulberry, pineapple, sisal
A. orientalis	Grapes, mango
Aspidiotus destructor	Avocado, coconut, guava, guayabano, maguey, mango, okra, papaya, pineapple, taro, yam
Chrysomphalus aonidum	Coconut

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
C. ficus	Breadfruit, cassava, guava, jackfruit, papaya, soursop
Clavaspis herculeana	Soursop
Fiorinia fioriniae	Avocado
Lepidosaphes rubrovittatus	Kenaf, okra
L. sp.	Lanzones, mango
Morganella longispina	Breadfruit, jackfruit
Pinnaspis aspidistrae	Kenaf, maguey, okra, pineapple, sisal
P. buxi	Santol
Pseudaonidia trilobitoformis	Breadfruit, jackfruit
Beanfly	
Ophiomyia phaseoli	Beans (common beans, cowpea, mungbean, soybean, winged bean, yardlong bean)
Bugs	
Anoplocnemis phasiana	Sweet potato
Brachyplatya deplanatus	Lanzones
Cyclopelta obscura	Cucurbits (bitter gourd, bottle gourd, chayote, cucumber, dish rag gourd, muskmelon, squash, watermelon, wax gourd)
Cyptopeltis (Nesidiocoris) tenuis	Cucurbits, tobacco
Geotomus pygmaeus	Tobacco
Helepeltis bakeri	Guava, kenaf
H. collaris	Cacao
H. sp.	Lanzones
Leptoglossus australis	Cucurbits
Macroscytus transversus	Sugarcane
Malcus flavidipes	Sweet potato
Nezara viridula	Tobacco
Physomerus grossipes	Cucurbits
Rhynchocoris longirostris	Citrus
Stephanitis typicus	Lanzones, soursop
Stibaropus callidus	Sugarcane
S. molginus	Sugarcane
Tectocoris diopthalmus perigrina	Okra
Tessaratoma longicorne	Rambutan
Coccids	
Crypticerya jacobsoni	Guava

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
Drosicha townsendi	Breadfruit, guava, jackfruit, soursop
Icerya aegyptiaca	Guava, mulberry, soursop
I. seychellarum	Guava, soursop
Leafhoppers	
Amrasca biguttula	Cotton, cucurbits, kenaf, peanut
Bothrogonia ferruzinea	Mango
Chanithus sp.	Ramie
Chunrocerus niveosparsus	Mango
Eumetopina flavipes	Sugarcane
Idioscopus clypealis	Soursop
Nephotettix nigropictus	Cucurbits
N. virescens	Rice
Peregrinus maidis	Corn, sorghum
Perkinsiella vastatrix	Sugarcane
Proutista moesta	Sugarcane
Recilia dorsalis	Rice
Ricania speculum	Sorghum
Tachardina minuta	Mango
Thaumatoscopus reflexus	Guava
Typhlocyba nigrobilineata	Mango
Mealybugs	
Dysmicoccus brevipes	Corn, maguey, pineapple, sisal, taro
Ferrisia tabaci	Tobacco
F. virgata	Avocado, breadfruit, cassava, cotton, grapes, guava, jackfruit, kenaf, lanzones, mango, orchids, papaya, ramie, rubber, santol, soursop, sweet potato
Nipaecoccus filamentosus	Avocado, breadfruit, jackfruit, lanzones, mulberry
Phenacoccus hirsutus	Cassava
Planococcus citri	Orchids
P. lilacinus	Avocado, breadfruit, guava, jackfruit, kenaf, lanzones, mango, okra, rambutan, taro
Pseudococcus brevipes	Orchids
Pseudococcus sp.	Banana
Puerto spinosus	Mango
Trionymus sacchari	Sugarcane

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
Planthoppers	
Gargara luconica	Kenaf, santol
Leptocentrus manilensis	Kenaf, solanaceous crops
Nilaparvata lugens	Rice
Sipylus sp.	Kenaf
Sogatella furcifera	Rice
Tarophagus proserpina	Taro
Tricentrus convergens	Grapes
T. plicatus	Kenaf
Plant lice	
Diaphorina citri	Citrus
Scale insects	
Aspidiella hartii	Ginger, yams
A. zingiberi	Ginger
Asterolecanium sp.	Lanzones
Aulacaspis tegalensis	Sugarcane
Ceroplastes cajani	Guava
C. rubens	Guava
C. sinensis	Grapes, guava, santol
Chrysomphalus dictyospermi	Orchids
Coccus viridis	Citrus, coffee, guava, lanzones, mango
Hemiberlesia lataniae	Kenaf
Lepidosaphes beckii	Citrus
L. gloverii	Citrus
L. sp.	Sugarcane
Parlatoria proteus	Orchids
Pinnaspis sp.	Citrus
Pulvinaria polygonata	Mango
P. psidii	Guava, mango
Saissetia coffeae	Coffee, guava, kenaf, santol
S. hemisphaerica	Okra
S. nigra	Guava, kenaf, mulberry, okra, papaya, rubber, soursop, tobacco
Stainers	
Dysdercus cingulatus	Kenaf, lanzones, okra, papaya
D. poecilus	Kenaf, okra
D. spp.	Cotton
Thrips	
Dichromathrips corbetti	Orchids
Elixothrips brevisetis	Banana
Frankliniella williamsi	Corn

Table 15. (Continued)

Insect/Mite Pests	Crops Affected
Hercinothrips femoralis	Banana
Selenothrips rubrocinctus	Mango
Thrips florum	Banana
T. tabaci	Cotton, cucurbits, garlic, onion, tobacco
Tube dweller	
Machaerota ensifera	Kenaf
Whiteflies	
Aleurocanthus spinosus	Kenaf
A. sp.	Lanzones
Bemisia tabaci	Cassava, garlic, onion, sweet potato, tobacco
Mites	
Acathrix trymatus	Coconut
Aceria tulipae	Garlic, onion
Brevipalpus ovobatus	Papaya
Calacarus brionesae	Papaya
Dolichotetranychus floridanus	Maguey, pineapple, sisal
Eriophyes sandorici	Santol
Notostrix attenuata	Coconut
Oligonychus orthius	Sugarcane
O. vefascoi	Coconut, kenaf
Panonychus citri	Citrus
Schizotetranychus lechrius	Taro
Scolacemus spiniferus	Coconut
Tenuipalpus pacificus	Orchid
Tetranychus kanzawai	Papaya, sugarcane
T. sp.	Potato, winged bean
T. telarius	Cassava
T. truncatus	Cucurbits, sugarcane

[a]Chewing/boring

[b]Sucking/boring

[c]Sucking/chewing

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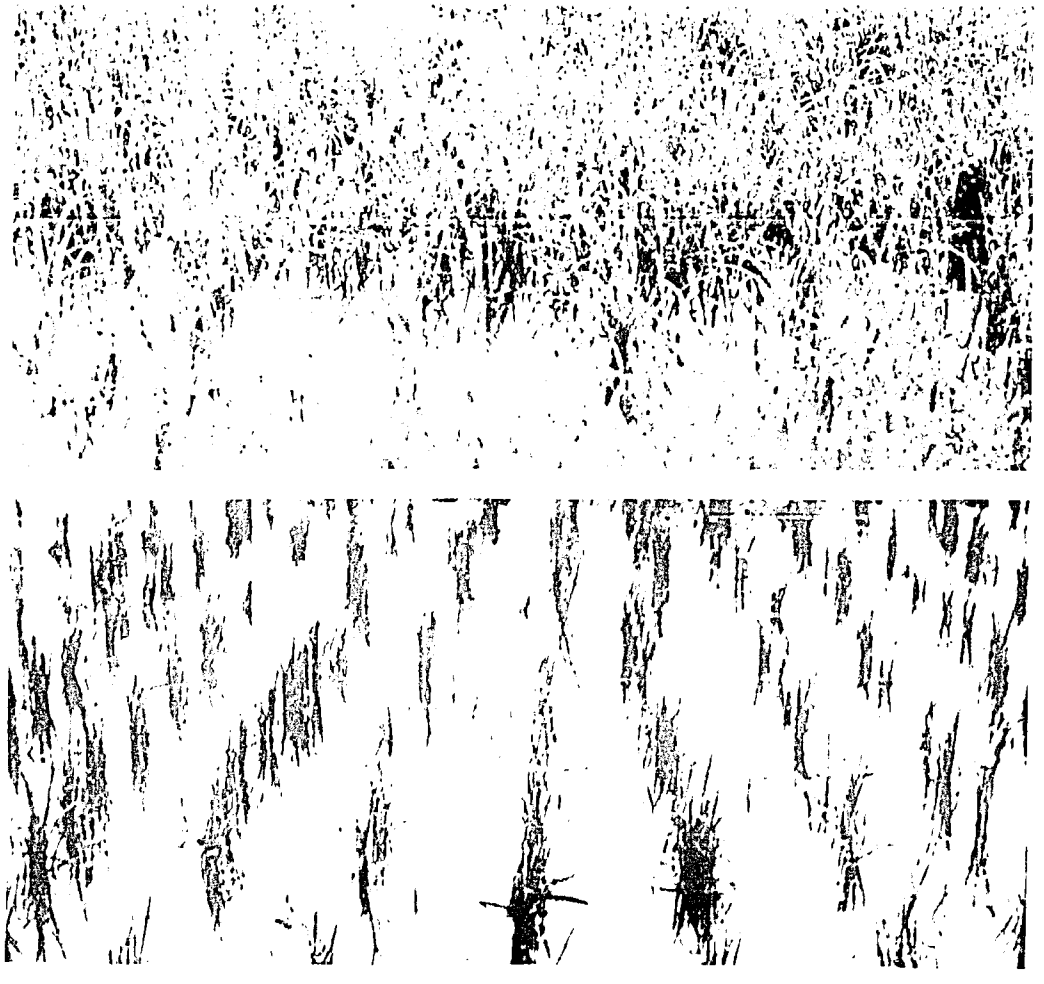

Weeds

Weeds are also considered limiting factors in crop production along with pests and diseases. They compete with the crop for light, water, and nutrients resulting in the wasteful use of farm inputs and reduction in yield. Available local data indicate that yield reduction in some vegetable crops can go up as high as 90% when weeds are not controlled. Weeds also serve as alternate hosts for pests and diseases, thus they should be considered in developing pest and disease control programs.

There is a stage in the growth of the crop when it is most vulnerable to weed competition. This is called the critical period of weed competition and is the most appropriate time to apply weed control measures. Studies showed that crops are most susceptible to weed competition during the first 25-30% of their life duration. Weed control, therefore, should be done when crop and weeds are still small and before the weeds offer serious competition to the crop. After the critical period, the crop can already compete favorably with the late-emerging weeds.

Table 16 indicates the critical period of weed competition, percentage yield reduction due to weeds, and physical methods of controlling weeds of various crops grown in the Philippines.

Table 17 presents the herbicides recommended for controlling weeds of different crops particularly annuals. Methods, rates and timing of application are not included since such information is available in several publications on chemical weed control. These are also indicated on the labels of herbicides available commercially.

Table 18 lists the scientific and common names of weeds and the crops that they affect.

Table 16. Weed response and control measures for crops grown in the Philippines

Crops	Critical Period of Weed Competition	Percentage Reduction in Yield	Control Measures	References
Abaca	Initial crop development phase		Ring weed abaca hills until plants have grown to their full size and no weeds can grow underneath.	Tabora (1979) Napi (1959)
			Cover crop during the early years to suppress weed growth. Grow kangkong (*Ipomoea aquatica*) and sweet potato since they deactivate viruses and minimize the virulence of abaca mosaic when the virus passes through them as intermediate hosts.	
Avocado			Grow intercrops such as small fruit crops (papaya, pineapple, banana), short-season field crops (corn, mungo), and vegetable crops (eggplant, tomato). Stop growing intercrops as soon as they interfere with operations in the orchard. At this stage, plant leguminous cover crop.	Coronel (1978)
Banana			In young plantations, practice mechanical weed control using tractor-drawn tillers. When plants are tall enough and leaves are safely above the drift of weedicides, practice mechanical weed control.	Anonymous (1974)
Beans	First ½ - ⅓ of crop life cycle (canopy cover)	24-86 (annual weeds)	Follow proper land preparation. Practice manual weeding.	William (1979) Dawson (1964) Kasasian and Seeyave (1969) Nieto, *et al.* (1968)
				Vengris and Stacewicz-Spuncakis (1971)
			Combination of intercropping, plant population, crop rotation, and various management practices reduces competition of several weed species.	William and Warren (1974) Bantilan, *et al.* (1974) Hardwood and Bantilan (1974)

Cabbage (transplanted)	Head formation	16-90	Transplanting reduces the exposure period of the tiny slow-growing seedling to weed competition and other production constraints. Clean all cultivation equipment before moving from one field to another. Reduce transfer of weed seeds through animal manure or the use of weed-infested compost. Reduce early weed competition by proper plowing immediately before planting. Practice manual weeding.	Paller and Soriano (1977) William (1979) William and Warren (1974)
Carrot	First half of the crop life cycle (root enlargement)	39-50 (*C. rotundus*)	Practice manual weeding. Reduce early weed competition by proper plowing immediately before planting.	William (1979) William and Warren (1974)
		45-62 (annual weeds)	Transplanting reduces the exposure period of the tiny, slow-growing seedling to weed competition and other production constraints. Mulch with dried plant materials such as straw from small grains.	
Cashew			Intercrop with small fruit crops like pineapple, papaya or some annual field and vegetable crops. Stop growing intercrops as soon as they interfere with operations in the orchard. Cover crop with leguminous crops. The area within a radius of 50-100 cm from the trunk should be kept free of weeds. Do not allow the cover crop to climb the cashew trees.	Coronel (1977)
Cassava	3-4 months after planting First 6 weeks from planting	44 66	Practice manual weeding. Weeds must be controlled when the canopy has not yet closed. But if labor is limiting, remove weeds between the 3rd and 4th month after planting.	Onochie (1975) Robles (1979)

Table 15. (Continued)

Crops	Critical Period of Weed Competition	Percentage Reduction in Yield	Control Measures	References
Citrus			Intercrop with upland rice, corn, peanut, and pineapple for young orchard. Cover crop with tropical kudzu, centrosema, and calopogonium. As the citrus trees grow older and occupy the space between rows, regularly clear away the viny cover crop from the base. At this stage, some grasses become established and start to compete with the cover crop making some farmers raise cattle to control the weeds.	Mendoza and Valmayor (1976)
			Always keep the nursery free of weeds by shallow cultivation.	Coronel, *et al.* (1980)
Corn	49 days from planting	50-70 (*Rottboellia exaltata*)	Practice thorough land preparation. Animal-drawn plowing needs at least two plowings alternated with several harrowings. When tractors are used, two passings of the off-set harrow, 1 week apart, generally give adequate land preparation.	Vega and Lapade (1968) Madrid (1972) Pamplona and Imlan (1976, 1977) Pamplona and Madrid (1979) Bantilan, *et al.* (1974)
	First 40 days of growth of the crop	46 (wet season) 22 (dry season)	Practice off-barring at 14-18 days after planting and hilling-up at 26-34 days after planting.	
			Use the square method of planting to facilitate cultivation in two directions at right angle to each other.	
			Intercrop corn with legumes such as peanut, mungbean, and soybean.	
			Destroy Aguingay (*R. exaltata* plants before they produce mature seeds.	
Cotton	5 weeks after planting (dry season)	35 (*Trianthema portulacastrum*)	Practice thorough land preparation before planting to initiate early seedling establishment. This also helps control weeds.	Guantes and Mercado (1973) Guantes (1976) Robinson (1976)

	7 weeks after planting (wet season, May planting)	45 (*C. rotundus*)	Practice hand and mechanical tillage in combination with application of herbicides.	Sankaran (1977) Burleson (1971)
	6-8 weeks after planting	74 (*E. colonum*)		
		75-88 (annual weeds)		
Cowpea	First month of crop growth	50-85	Practice hand or manual weeding.	Moody (1973) IRRI (1976) Moody (1979)
Cucumber	Up to 5 weeks if *C. rotundus* is the competing weed	40-50	Practice manual weeding and thorough land preparation.	William (1979) William and Warren (1974)
	First ⅓ of crop life cycle (initiation of runners)		Place fertilizer and irrigation water near the crop to reduce the overall growth of weeds in the field.	
			Mulch with dried rice straw or other dried plant materials.	
Durian			Intercrop durian with short-season leguminous crops. If this is no longer feasible, plant a cover crop.	Coronel (1977)
Garlic	First 13 weeks until bulbing occurs	89 (*C. rotundus*)	Mulch with dried rice straw.	William and Warren (1975)
Jute	First 6 weeks after sowing	60	Practice hand weeding.	Saraswat (1976) Saraswat and Mitra (1977)
			Minimize weed intensity in the initial stages by thorough land preparation.	
			Top dress nitrogenous fertilizer immediately after the first weeding (3-week stage) to accelerate vegetative growth of the plant.	
Lanzones			Hoe the area around the trunk to kill the weeds.	Coronel (1977)

Table 16. (Continued)

Crops	Critical Period of Weed Competition	Percentage Reduction in Yield	Control Measures	References
Mango			Cover crop with perennial legumes to suppress the growth of weeds.	Cuevas (1976)
Mungbean	5 weeks after planting (wet season)	95 (wet season)	Practice manual and mechanical weeding.	Madrid and Vega (1971) Moody (1979)
	3 weeks after planting (dry season) 4-6 weeks after planting	77 (dry season)	Practice interrow cultivation.	
Okra	First 7 weeks	62 (*C. rotundus*)		William and Warren (1974)
Onion (direct-seeded)	65 days from seeding	67-68 (*C. rotundus*)	Practice manual and mechanical weeding. Plow properly immediately before planting. Place fertilizer and irrigation water near the crop.	William and Warren (1974) Bleasdale (1959) Shadbolt and Holm (1956) Wick, *et al.* (1973)
	First half of the crop life cycle (bulbing stage)	20-92 (annual weeds)	Transplant seedlings to reduce the exposure period to weed competition and other production constraints. Mulch with dried plant materials.	Paller and Soriano (1977)
Pineapple			Practice handweeding. Follow chemical recommendations.	Cuevas and Barba (1970)
Potato	6-8 weeks after emergence	10-18	Practice four interrow cultivations at weekly intervals starting 7 days after planting. Hand-weed three times during crop growth.	Paller, *et al.* (1970) Paller and Soriano (1977)
Rice (lowland)		69 (general)	Practice good farm management, e.g., prevent seed production of weeds by cutting or mowing them before they flower.	Madrid, *et al.* (1972) Lubigan and Vega (1971) Vega, *et al.* (1967) Lubigan and Mercado (1974)

	7-40 days after transplanting	72 (*Echinochloa crusgalli*) 35 (*Monochoria vaginalis*) 79 (*Scirpus maritimus*)	Use clean farm equipment. Clear irrigation and drainage canals. Follow mechanical methods using hands, hoes, weeders, and the like.	Okafor and De Datta (1976)
Rice (upland)	40 days after seeding	43 (drilled upland rice-*C. rotundus*) 41 (broadcast upland rice-*C. rotundus*) 79 (general)	Follow cultural methods such as plowing, harrowing, flooding, interrow cultivation, and the like. Use herbicides.	
Rubber	First 4-5 years after establishment		Grow legume cover crops in the interrow areas.	Pushparajah and Woo (1971)
Sorghum	First 20-30 days of crop growth	20-100	Practice handweeding. Use mechanical methods such as interrow cultivation, hoeing, and the like. Plant early to avoid competing with the flush of weeds that comes with heavy monsoon rains. Observe proper plant density/spacing (250,000-350,000 plants/na). Practice thorough land preparation.	Shetty (1979) Danielson (1969) Pamplona and Madrid (1979)
Soybean	30-40 days	50-60	Mulch with rice straw. Observe narrow row spacing and proper plant density. Practice handweeding.	Moody (1979, 1974) Vega, *et al.* (1970) Waranyumat and Kotama (1973)

Table 16. (Continued)

Crops	Critical Period of Weed Competition	Percentage Reduction in Yield	Control Measures	References
Sugarcane	First 4 months of the crop life cycle	25-93	Apply herbicides.	Posa (1977)
			Do manual weeding along the cane rows, and hilling-up.	Obien and Baltazar (1978)
			Intercrop sugarcane with mungbean, soybean, peanut, rice, or corn.	
Sunflower	4 weeks after planting	20-72	Practice handweeding.	Guantes (1978)
Sweet potato	2-4 weeks after planting	3-42 (depending on plant spacing)	Practice thorough land preparation.	Kasasian and Seeyave (1969)
			Perform early manual weeding.	Robles (1978)
				Talatala, *et al.* (1978)
Taro	3-4 months old (upland taro)		Apply herbicide through irrigation water.	De la Peña, *et al.* (1971)
	2-3 months before harvest (lowland taro)			De la Peña (1979)
				Plucknett and dela Peña (1970)
			Flood the field of lowland taro at a water depth of 2.5-5 cm to prevent weed germination.	Plucknett and dela Peña (1970)
Tomato (transplanted)	First 4 weeks after transplanting	39-86	Mulch with rice straw.	Paller and Soriano (1977)
			Practice handweeding.	Kasasian and Seeyave (1969)
			Reduce weed competition by transplanting instead of direct seeding.	William and Warren (1974)
Yam	First 3 months	53 (*C. rotundus*)		Moody and Ezumah (1974)
				Kasasian and Seeyave (1969)

Table 17. Herbicides recommended for controlling weeds of crops grown in the Philippines

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Weeds Controlled
Ametryne	Ametryn WP Gesapax 80 WP	Abaca, banana corn, sugarcane	Annual weeds
Atrazine	Atradex 80% WP Atrazine WP Atranex 80 WP Gesaprim 500 FW Gesaprim 80% WP Premox 80 WP Bentrazine 800 WP Atrazine Atred 80 WP	Corn, sorghum, sugarcane	Annual weeds
Atrazine + Ametryne	Gesapax Combi	Abaca, banana corn, sugarcane	Annual weeds
Asulam (in combination with ioxymil)	Asulox 40	Sugarcane	Perennial sedge
Bentazon	Basagran	Rice	
Bromacil	Hyvar X	Pineapple	Annual grasses and perennial weeds
Butachlor	Machete 5 g Machete 600 EC Lambast 5 g Lambast 600 EC	Lowland rice, upland rice, mungbean, soybean	Annual, and perennial sedges
Chloramben	Amiben	Beans (lima, kidney), corn, peanut, soybean, rice	Annual grasses
2-4-D	Miracle 2, 4-D Amine Agchem 2, 4-D Amine DMA-6 Esteron Weed Brush-killer Formula 40 Hedonal Granule Hedonal Liquid Hoechst 2, 4-D Amine 4 Hoechst 2, 4-D IBE 2, 4-D Amine 6 Marsman 2, 4-D Ester 2, 4-D Granules 3.2% Planters 2, 4-D Amine Plantguard 2, 4-D Granules Planters, 2, 4-D Ester Planters, 2, 4-D Granules	Rice Corn Sugarcane	Annual weeds

Table 17. (Continued)

Common Name of Active Chemicals	Typical Brand Names	Recommended for	Weeds Controlled
	Plantguard 2, 4-D Liquid IBE Shell 2, 4-D Granules Shell 2, 4-D Ester Shell Amine 2, 4-D		
Propanil	Stam F-34 Stam LV-10	Rice	Annual grasses
TCA	Nata WP 92-95 Nata G 92-95	Sugarcane	General weed killer
Terbacil	Sinbar	Grapes	Annual grasses
Thiobencarb	Saturn EC Saturn S	Rice	Annual grasses
Thiobencarb + 2, 4-D	Saturn D	Rice	Annual grasses
Trifluralin	Treflan EC	Rice	Annual grasses
	Treflan R Granules	Soybean, tomato,	Annual grasses
	Triflurex	Mungbean, cabbage	Annual weeds
Trifluralin + 2, 4-D	Treflan R	Rice	Annual weeds

Table 18. Weed-crop index

Scientific Name of Weeds	English Common Name of Weeds	Crops Affected
Ageratum conyzoides (Hypericum perforatum)	Tropic ageratum goat weed	Corn, sugarcane
Amaranthus spinosus	Spiny (thorny) amaranth	Corn, onion, peanut, sugarcane, tomatoes, upland rice
A. viridis	Slender amaranth	Sugarcane
Ambrosia psilostachya	Ragweed	Avocado, ornamentals (flowers), sugarcane
A. spp.	Ragweed	Avocado, beans (lima, kidney), citrus, corn, ornamentals (flowers), peanut, peas, soybean, squash, sugarcane, sweet potato
Brachiaria mutica	Para grass	Citrus, lowland rice, squash, sugarcane, sweet potato
Canna indica	Queensland arrowroot	Abaca

Table 18. (Continued)

Scientific Name of Weeds	English Common Name of Weeds	Crops Affected
Celosia argentea	—	Corn, lowland rice, onion, peanut, upland rice
Cleome ciliata	Spindle top	Sugarcane
C. rutidosperma	Spindle top	Corn, peanut, soybean, sugarcane
Commelina benghalensis *C. diffusa*	Dayflower	Bean (lima), corn, lowland rice, peanut, peas, soybean, sugarcane, upland rice
Conyza canadensis	Horse weed	Pineapple
Cynodon dactylon	Bermuda grass	Beans (bush, green, lima, pole, snap), citrus, cotton, grapes, sorghum, soybean, sugarcane
Cyperus compactus *C. imbricatus*	Nutsedge (nutgrass)	Lowland rice
C. rotundus	Purple nutsedge (nutgrass)	Cabbage, corn, grapes, mungbean, pineapple, sugarcane, tomato, upland rice
C. difformis	Small flower umbrella plant	Lowland rice, upland rice
C. iria	Rice flatsedge	Upland rice, lowland rice
C. kyllingia	Kyllinga	Upland rice
Dactyloctenium aegyptium	Crowfoot grass	Corn, grapes, lowland rice, onion, peanut, sorghum, sugarcane, upland rice
Desmodium sp.	—	Sorghum
D. triflorum	—	Upland rice
Digitaria macrobachne	Crabgrass	Lowland rice, upland rice
D. sanguinalis	Large crabgrass	Beans (bush, green, lima, pole, snap), corn, cotton, cucumber, eggplant, onion, peanut, pineapple, potato, soybean, squash, sugarcane, sweet potato, upland rice
Echinochloa crusgalli	Barnyard grass	Beans (lima, kidney), corn, grapes, lowland rice, onion, peanut, potato, soybean,
E. cruspavonis	Barnyard grass	Squash, sugarcane, sweet potato, upland rice

Table 18. (Continued)

Scientific Name of Weeds	English Common Name of Weeds	Crops Affected
E. colonum	Jungle rice	Corn, lowland rice, onion, peanut, sorghum, upland rice
Eclipta prostata *E. alba*	Eclipta	Corn, upland rice
Eleusine indica	Goose grass	Corn, peanut, pineapple, soybean, sugarcane, upland rice, lowland rice
Euphorbia hirta	Garden spurge Snake weed Cat's hair	Mungbean, sugarcane
Fimbristyllis littoralis *F. dichotoma*	Ubod-ubod (Tagalog)	Lowland rice
Galinsoga farviflora	(Small flower) galinsoga	Potato
Helioptropium indicum	Indian heliotrope	Corn, onion, peanut
Imperata cylindrica	Cogon, Spear grass	Coconut
ipomoea sp. *I. triloba*	Morning glory	Corn, mungbear, pineapple, soybean, sugarcane, tomato, upland rice
Leptochloa chinensis	Red sprangle top	Lowland rice
L. panicea	—	Lowland rice
Laurentia longiflora	Star of Bethlehem	Sugarcane
Ludwigia octovalvis	—	Lowland rice
Maranta arundinaea	Arrowroot	Abaca
Marsilea crenata	Clover fern	Lowland rice
Mimosa pudica	Sensitive plant	Corn
M. invisa	Sensitive plant (giant)	Pineapple
Monochoria vaginalis	Pickerel weed (Gabing uwak)	Lowland rice
Paederia tomentosa	—	Sugarcane
Panicum repens	Torpedo grass	Lowland rice, pineapple
P. maximum	Guinea grass	Avocado, citrus
Paspalidium flavidium	Giting Lisang kalabaw	Corn, peanut
Paspalum conjugatum	Carabao grass	Cacao, citrus, onion, pineapple
Plantago lanceolata	Buckhorn plantain	Sugarcane
Portulaca oleracea	Common purslane	Bean, corn, cotton, cucumber,

Table 18. (Continued)

Scientific Name of Weeds	English Common Name of Weeds	Crops Affected
		grapes, onion, peanut, peas, soybean, squash, sugarcane, sweet potato, upland rice
Rottboellia exaltata	Raoulgrass Itchgrass	Bean, corn, mungbean, onion, peanut, soybean, sugarcane, tomato, upland rice
Saccharum spontaneum	—	Pineapple
Scirpus maritimus	Bulrush	Lowland rice
Sorghum halepense	Johnson grass	Avocado, beans (bush, green, lima, pole, snap), citrus, corn, cotton, grapes, ornamentals (flowers), peanut, peas, soybean, squash, sugarcane, sweet potato
Spergula arvensis	Corn spurry (devil's gut)	Corn, potato
Sphenoclea zeylanica	Goose weed (silhigon)	Lowland rice
Synedrella nodiflora	Synedrella	Corn, soybean
Tithonia diversifolia	Wild sunflower	Beans (kidney, lima), peanut, peas
Trianthema portulacastrum	Horse purslane	Corn, peanut
Trichachne insularis	—	Pineapple
Vernonia cinerea	Vernonia	Upland rice

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Appendix A

Common Names and Scientific Names of Crops Grown in the Philippines[a]

English and Other Common Names	Scientific Names	Pilipino or Local Names
Abaca	*Musa textilis*	Abaka
African oil palm	*Elaeis guineensis*	—
African violet	*Saintpaulia* spp.	—
Angled luffa, ribbed gourd	*Luffa acutangula*	Patolang tagalog
Anthurium	*Anthurium andraeanum*	—
Arrowroot, West Indian arrowroot	*Maranta arundinacea*	Uraro
Asparagus	*Asparagus officinalis*	—
Avocado	*Persea americana*	—
Banana/Plantain	*Musa* spp.	Saging
Bittermelon, bitter gourd, balsam pear	*Momordica charantia*	Ampalaya, amorgoso
Black pepper	*Piper nigrum*	Paminta
Breadfruit	*Artocarpus altilis*	Rimas
Cabbage	*Brassica oleracea* var. *capitata*	Repolyo
Cacao, cocoa	*Theobroma cacao*	Kakaw
Carrot	*Daucus carota*	Karot
Cashew	*Anacardium occidentale*	Kasoy, balubad
Cassava, manioc	*Manihot esculenta* (Syn. *Manihot utilissima*)	Kamoteng kahoy
Castor oil plant, castor bean	*Ricinus communis*	—
Celery	*Apium graveolens* var. *dulce*	Apyo, seleri, kintsay
Chayote, vegetable pear	*Sechium edule*	Sayote
Chico, sapodilla	*Achras zapota*	Tsiko
Chinese cabbage, petsai	*Brassica pekinensis*	Petsay Baguio
Chinese water chestnut, water chestnut	*Eleocharis dulcis*	Apulid
Chrysanthemum	*Chrysanthemum morifolium*	Krisantemo, rosas-Hapon
Citrus		
Calamondin	*Citrus mitis* (Syn. *Citrus madurensis*)	Kalamunding, kalamansi

English and Other Common Names	Scientific Names	Pilipino or Local Names
Mandarin	*Citrus reticulata*	Dalanghita, sintunis
Pummelo, shaddock	*Citrus grandis* (Syn. *Citrus maxima*)	Lukban, suha
Sweet orange, common orange	*Citrus sinensis*	Kahel, dalandan
Coconut	*Cocos nucifera*	Niyog
Coffee		
Arabica or Arabian coffee	*Coffea arabica*	Kape
Liberica or Liberian coffee	*Coffea liberica*	Kapeng barako
Robusta coffee	*Coffea canephora*	Kape
	Coffea excelsa	Kape
Common bean, kidney bean, snap bean, French (string) bean, haricot bean	*Phaseolus vulgaris*	Habichuelas
Corn, maize	*Zea mays*	Mais
Cotton, American upland cotton	*Gossypium hirsutum*	Bulak
Cowpea, Southern pea, blackeye pea	*Vigna unguiculata* (Syn. *Vigna sinensis*)	Paayap, kibal
Cucumber	*Cucumis sativus*	Pipino
Durian	*Durio zibethinus*	Durian
Eggplant, aubergine	*Solanum melongena*	Talong
Garlic	*Allium sativum*	Bawang
Ginger	*Zingiber officinale*	Luya
Gladiolus	*Gladiolus* spp.	—
Grapes		
Wine grape, Old World grape	*Vitis vinifera*	Ubas
Fox grape	*Vitis labrusca*	Ubas
Muscadine grape	*Vitis rotundifolia*	Ubas
Greater yam, Asian greater yam, Asian wing-stemmed yam	*Dioscorea alata*	Ubi
Guava, common guava	*Psidium guajava*	Bayabas
Horseradish tree	*Moringa oleifera*	Malunggay
Jackfruit	*Artocarpus heterophyllus*	Nangka, langka
Jute	*Corchorus capsularis*	Saluyot, pasao na bilog
	Corchorus olitorius	Saluyot, pasao na haba
Kalanchoe	*Kalanchoe* spp.	—
Lablab bean, hyacinth bean	*Lablab purpureus* (Syn. *Dolichos lablab*)	Batao

English and Other Common names	Scientific Names	Pilipino or Local Names
Lanson, lanzones, langsat	*Lansium domesticum*	Lansones
Lesser yam, Asian lesser yam, Chinese yam, potato yam	*Dioscorea esculenta*	Tugui
Lettuce	*Lactuca sativa*	Letsugas
Lima bean, butter bean	*Phaseolus lunatus*	Patani
Maguey	*Agave cantala*	Maguey
Mango	*Mangifera indica*	Mangga
Mangosteen	*Garcinia mangostana*	—
Mulberry	*Morus alba*	—
Mungbean, green gram, golden gram	*Vigna radiata* (Syn. *Phaseolus aureus*)	Balatong, mungo
Muskmelon[b]	*Cucumis melo*	Milon
Mustard	*Brassica juncea*	Mustasa
Okra, lady's finger	*Abelmoschus esculentus* (Syn. *Hibiscus esculentus*)	Okra
Onion	*Allium cepa*	Sibuyas
Papaya, papaw, pawpaw	*Carica papayae*	Papaya
Pea		
Edible-podded pea, sugar pea, Chinese pea	*Pisum sativum* (Macrocarpon group)	Sitsaro
Garden pea, English pea, green pea	*Pisum sativum*	Gisantes
Peanut, groundnut	*Arachis hypogaea*	Mani
Pechay	*Brassica chinensis*	Pechay
Pigeon pea, red gram	*Cajanus cajan*	Kadyos
Pili	*Canarium ovatum*	Pili
Pineapple	*Ananas comosus* (Syn. *Ananas sativus*)	Pinya
Poinsettia	*Euphorbia pulcherrima*	—
Potato, Irish potato, white potato	*Solanum tuberosom*	Patatas
Orchid	*Cattleya* spp. *Dendrobium* spp. *Phalaenopsis* spp. *Vanda,* spp., etc.	Orkid
Radish	*Raphanus sativus*	Labanos
Rambutan	*Nephelium lappaceum*	Rambutan

English and Other Common names	Scientific Names	Pilipino or Local Names
Ramie	*Boehmeria nivea*	Rami
Rice	*Oryza sativa*	Palay
Rose	*Rosa* spp.	—
Rubber	*Hevea brasiliensis*	—
Santol	*Sandoricum koetjape*	Santol
Sesame	*Sesamum indicum*	Linga
Soybean	*Glycine max*	Utaw
Sisal	*Agave sisalana*	Sisal
Sorghum, grain sorghum	*Sorghum bicolor*	Batad
Soursop, Guanabana	*Annona muricata*	Guayabano
Squash, pumpkin, vegetable marrow, Boston marrow, winter squash	*Cucurbita maxima*	Kalabasa
Vegetable marrow, winter and summer squash	*Cucurbita pepo*	Kalabasa
Crookneck pumpkin, winter squash	*Cucurbita moschata*	Kalabasa
Star apple	*Chrysophyllum cainito*	Caimito
Strawberry	*Fragaria* spp.	—
Sugarcane	*Saccharum officinarum*	Tubo
Sunflower	*Helianthus annuus*	—
Swamp morning glory, swamp cabbage, water convolvulus	*Ipomoea aquatica*	Kangkong
Sweet pepper, bell pepper	*Capsicum annuum*	Sili
Sweet potato	*Ipomoea batatas*	Kamote, kamoteng baging
Sweetsop, sugar apple	*Annona squamosa*	Atis
Tabasco pepper	*Capsicum frutescens*	Siling maanghang
Tannia, yautia, new cocoyam	*Xanthosoma sagittifolium*	Gabing Cebu, gabing San Fernando
Taro, dasheen, old cocoyam	*Colocasia esculenta*	Gabi, gabing Tagalog, gabing Calamba
Tobacco	*Nicotiana tabacum*	Tabako
Tomato	*Lycopersicon esculentum*	Kamatis
Vanilla	*Vanilla planifolia*	Banilya
Watermelon	*Citrullus lanatus* (Syn. *Citrullus vulgaris*)	Pakwan

English and Other Common Names	Scientific Names	Pilipino or Local Names
Wax gourd, white gourd	*Benincasa hispida*	Kondol
Wheat	*Triticum aestivum*	Trigo
White-flowered gourd, white calabash gourd	*Lagenaria siceraria*	Upo
Winged bean	*Psophocarpus tetragonolobos*	Calamismis, sigarilyas
Yam bean	*Pachyrrhizus erosus*	Singkamas
Yardlong bean, asparagus bean	*Vigna unguiculata* subsp. *sesquipedalis*	Sitao

[a]Adapted from "Scientific names of some important Philippine agricultural crops." Compiled by N.D. Bondad and S.I. Yabes (1976). PCARRD, Los Baños, Laguna.

[b]Muskmelon and cantaloupe are used interchangeably in some places but the name "cantaloupe" generally designates the small, dark-skinned, netted, salmon-flesh muskmelons classified as *Cucumis melo* var. *reticulatus*. All cantaloupes are muskmelons but some types of muskmelons such as Honey Dew, Persian, and Casaba are not cantaloupes.