



Manual Cactus Pear Agronomic Practices

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RESEARCH
PROGRAM ON
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Why Cactus Pear ...



- Drought tolerant
- Adapted to harsh and dry conditions
- Evergreen plant
- Easy to establish, maintain and use
- Multipurpose plant
- Fodder provider
- Resolve livestock watering
- High palatability & high in soluble carbohydrates





Cactus pear Multifunctionality

**Fruit & Cladodes
(high nutritional value)**





Cactus pear Multifunctionality



**Cladodes & Waste Fruit
(highly palatable livestock feed)**



Cactus pear Multifunctionality

Agro-industries
(juices, liquor, jellies, marmalade)



Cactus pear Multifunctionality

Cosmetics & Medicinal Uses





Cactus pear agronomic practices



**Combat desertification
& Rangeland improvement**





Cactus pear agronomic practices

Cactus cultivation

Cactus can be planted as a sole crop or intercropped with other crops.



Cactus with Maize



Cactus as sole crop



Cactus with Napier





Cactus pear agronomic practices



Site selection

- Well-drained sandy loam soils are recommended
- Heavy clay soils are not appropriate for cactus pear cultivation
- Sites that have minimal frost risk are preferred
- Select sunny areas and avoid shady ones

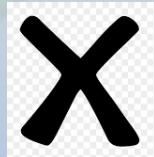
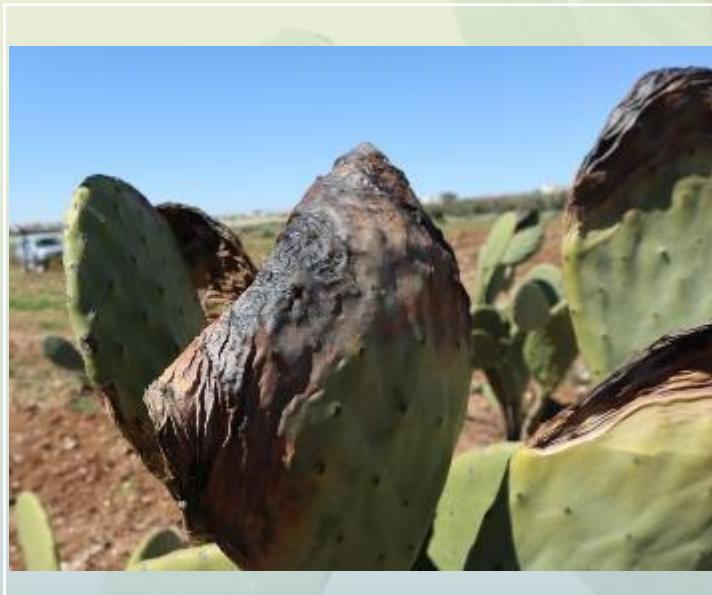




Cactus pear agronomic practices

Planting date

- Planting usually takes place in the last third of the dry season to allow the cutting to develop the initial roots and to reduce the occurrence of plant Pathogens in the rainy season
- In the areas that have the risk of frost, planting should be done after the risk of frost and flooding is over



Cactus pear agronomic practices

Planting Methods

The planting methods varies according to the production system and environment.

Cactus pear can be planted either in pits or in furrows



Planting in Pits

Planting in Furrows

Cactus pear agronomic practices

Plant spacing

The recommended plant spacing varies according to the production system, species growth habit, growing conditions and the purpose of the cactus pear plantation.



Cactus pear agronomic practices

Plant spacing

- Growing under natural conditions, wide spacing of plantings in low rainfall areas generally should be practiced avoiding competition for soil moisture.
- Under traditional management practices the recommended spacing for fodder production is 1 m in the row and 2 m between the rows while for fruit production is 3 m in the row and 4 m between the rows



Cactus for fruit production



Cactus for fodder production

Cactus pear agronomic practices

Planting in Pits

Pits can be prepared manually or mechanically if machines are available.



Cactus pear agronomic practices

Planting in Pits

- Depth of each pit is 30 - 40 cm
- 3 - 5 kg of organic manure should be incorporated into the soil in each pit



Cactus pear agronomic practices

Planting in furrows

- Field should be plowing; harrowing to break the soil clods into smaller mass and field should be leveled
- Consider the right orientation and open furrows 30 - 40 cm deep
- Depending on the soil condition, organic manure or/and Nitrogen fertilizer should be added before planting



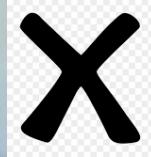


Cactus pear agronomic practices



Planting materials

- Cactus pear is vegetatively propagated
- Identify the varieties that will adapt best to your environmental conditions and will suit your growing purposes
- Select robust and healthy cladodes of medium to large size from healthy adult plants





Cactus pear agronomic practices



Planting materials

- Choose one- or two-year healthy cladodes
- Cut the cladodes from the joints by inserting the knife between the joints of the cladodes as demonstrated below:



Cactus pear agronomic practices

Planting materials

Single and multiple cladode cuttings (one or two mature cladodes attached to basal cladode) are used for cactus pear plantation. Multiple cladode cuttings speed up the plant development and fruiting is earlier **BUT** they required higher establishment cost “bigger size and mass cladode are more difficult to handle and transport”



Two cladodes attached to basal cladode



One cladode attached to basal cladode



Single cladode



Cactus pear agronomic practices



Planting materials

After harvesting the cladodes, it is recommended to leave them in the shade on a dry surface for 1 - 2 weeks to allow the cut portion to callus



Cactus pear agronomic practices

Cactus pear planting

- Planting basal cladode in diagonal position is advisable
- The orientation of cladode plantation that resulted in greatest exposure to sunshine is highly recommended



Cactus pear agronomic practices

Cactus pear planting

Half or two thirds of the cladode must be placed slightly tilted and buried in the soil.



Cactus pear agronomic practices

Cactus pear planting

Same procedures should be followed when planting in furrows





Cactus pear agronomic practices



Cactus pear planting

In order to develop strong plants with strong root systems, cactus pear plants are recommended to be protected for 2 - 3 years.



X



X



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Cactus pear agronomic practices



Weeding management

Cactus has shallow roots system. Therefore, weeds compete with cactus for nutrients, water and light

Weed control is important to increase cactus productivity and recommended at an early stage of growth to minimize the competition with cactus pear crop cactus pear crop

- Hand weeding is the best despite limitation in available labor and high cost
- Mechanical cultivation should be restricted to a minimum, to avoid damaging the shallow root system
- Chemical weed control can be applied carefully



Cactus pear agronomic practices

Irrigation

Cactus pear is drought tolerant crop thus, irrigation is not a common practice. However, under certain conditions (related to soil and environmental conditions), the application of small amounts of water (localized irrigation) can make significant increase in the crop yield



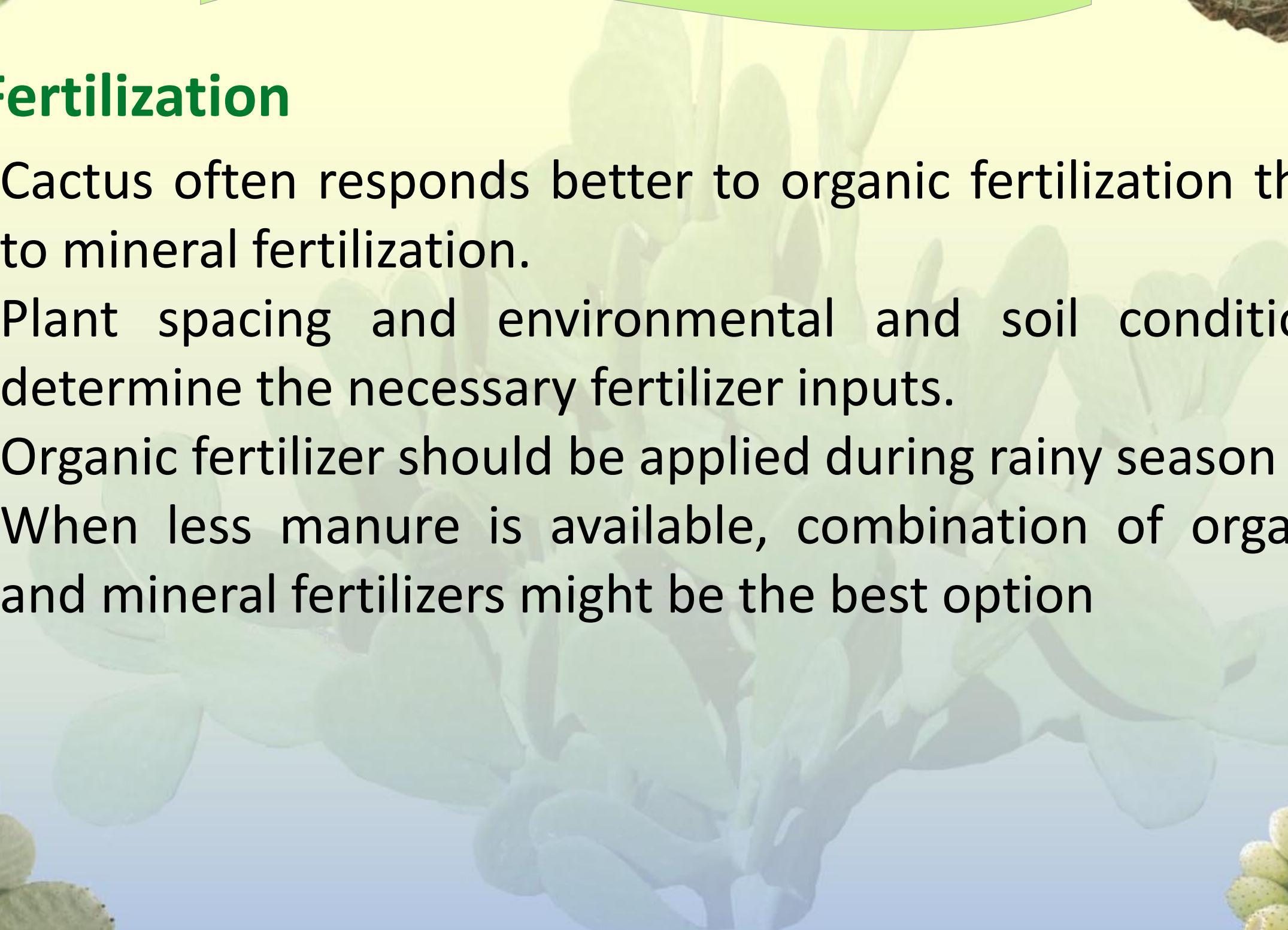
Drip irrigation in the cactus orchard



Cactus pear agronomic practices



Fertilization

- Cactus often responds better to organic fertilization than to mineral fertilization.
 - Plant spacing and environmental and soil conditions determine the necessary fertilizer inputs.
 - Organic fertilizer should be applied during rainy season
 - When less manure is available, combination of organic and mineral fertilizers might be the best option
- 



Cactus pear agronomic practices

Pruning

- Pruning begins in the first year of establishment to form the desired plant shape.
- Pruning timing and intensity are subjective to environmental conditions, plant growth habit and plant spacing
- Damaged cladodes should be removed
- Leave no more than 2 daughters cladodes on a parent cladode
- Avoid pruning during rainy or cold periods





Cactus pear agronomic practices



Fruiting

- Plants produce fruit 3-4 years after planting and; reach full production after 7 years.
- Maximum fruit growth rate and harvest size occur when no more than **six fruits** are left on a fruiting cladode
- Fruit thinning should be done from 2 weeks before bloom to 2 weeks after set
- Fruit thinning should be applied together with irrigation to get a significant increase in fruit size and percent flesh
- Fruits harvesting should be done using sharp knife, fruits should be cut at the base of the fruit with a small piece of cladode left attached to it



Cactus pear agronomic practices

Animal feed

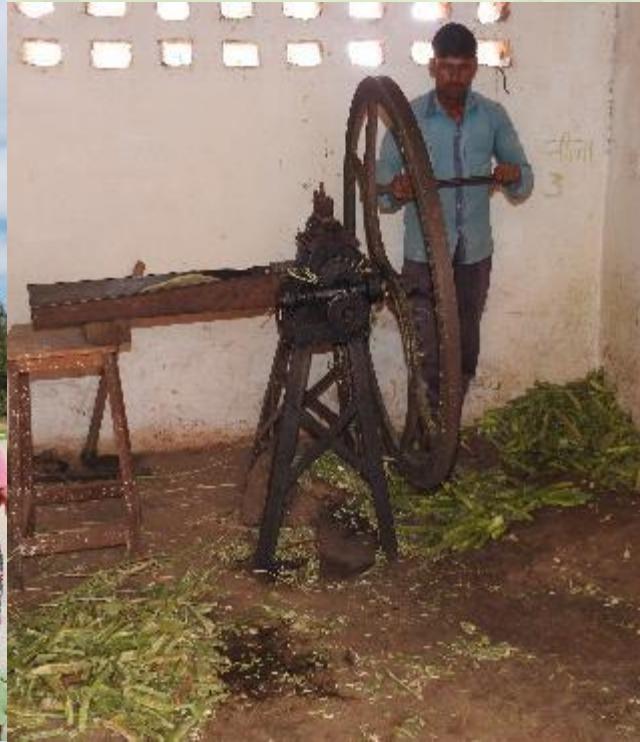
- Depending on growth and environmental conditions, cactus plantations can be used for fodder production 3 years after planting
- Cactus is cut and carry crop, cladodes need to be chopped to reduce its size for animals to promote consumption



Cactus pear agronomic practices

Animal feed

- Cactus chopping can be performed either
 - Manually with knives or
 - Mechanically using choppers: different types of choppers are now available in the market



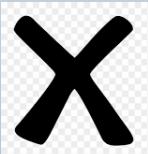


Cactus pear agronomic practices



Animal feed

It is highly recommended to avoid direct grazing of cactus (high water content palatable plants). The plant can easily be destroyed by animals. Grazing can cause cladodes to rot. Cactus cladodes must be cut and carried out to avoid risk of direct grazing.



Cactus pear agronomic practices

Animal feed

- Cactus cannot be fed alone as it may cause animal diarrhea and weight loss
- Cactus is low in protein and fibers thus, supplement with both CP and fiber in a mixed diet is recommended
- Cactus is rich in soluble carbohydrates, therefore, molasses should be avoided



Cactus pear agronomic practices

Animal feed

Cactus can improve the nutritive value of poor-quality diets and increases the average daily gain of growing ruminants as well as improves the milk quality and quantity

Cactus can be used up to 30 percent of the feed ration





Insect pests of cactus pear



Hemiptera

Hemiptera Gray Chinch Bug: *Chelinidea tabulatus*

Red Chinch Bug: *Hesperolabops gelastops*

Cactus cochineal (*Dactylopius opuntiae*)



Insect pests of cactus pear

Cactus cochineal (*Dactylopius opuntiae*)

It is considered the most important insect pest in cactus orchards worldwide. It is easily recognizable: large woolly masses of white wax cover its body and, when crushed, the bright crimson color of the body fluid runs out and contrasts with the cottony color. Cochineal insects live on the surface of the cactus plants. Plant damage is caused by the females and nymphs as they suck sap from the cladodes and fruits.



Dactylopius opuntiae



Insect pests of cactus pear



Cactus cochineal Treatment & Management

Cochineal is very easy to spread (wind, human, animals, fodder and streaming), the insect control can be done through:

- Early control is very important
- Remove and burn infected plants
- Biological control (*Cryptolaemus montrouzieri*)
- Apply recommended insecticides (the first-instar larvae are the most susceptible and the easiest target)
- It is recommended not to cultivate soil infected by fungus for 2 - 3 years and to remove sources of inoculum (roots of previous crops).





Insect pests of cactus pear



Lepidoptera

Cactus moth (*Cactoblastis cactorum*)

Zebra cactus worm (*Olycella nephelepsa*)

Cactus white worm (*Megastes cyclades*)

Cactus pad joint borer (*Metapleura potosi*)



Cactoblastis cactorum





Insect pests of cactus pear



Coleoptera

Cactus weevil (*Metamasius spinolae*)

Shot hole weevil (*Gerstaeckeria* spp.)

Spine Borer/Areole weevil (*Cylindrocopturus biradiatus*)

**Cactus Insects are controlled by chemical insecticides,
Remove and burn infected plants**





Fungal diseases of cactus pear

Black spot (*Pseudocercospora opuntiae* Ayala-Escobar)

Cladode and fruit rot (*Lasiodiplodia theobromae*)

Alternaria dry rot (*Alternaria* spp)

Armillaria root and stem rot (*Armillaria mellea* (Vahl) P. Kumm)

Cottony rot (*Sclerotinia sclerotiorum* (Lib))

Rust (*Aecidium opuntiae* Magn.)

Phytophthora foot rot (*Phytophthora nicotianae*)

Pythium crown and stem rot (*Pythium aphanidermatum* Edson)

Fusarium root rot (*Fusarium oxysporum* f. sp. *Opuntiarum*)

Grey mould (*Botrytis cinerea* Pers.



Pseudocercospora opuntiae





Fungal diseases of cactus pear



Fungal diseases Control Recommendation

Apply copper-based fungicides just before the rainy season
Remove and destroy infected cladodes.

It is recommended not to cultivate soil infected by fungus for 2 - 3 years and to remove sources of inoculum (roots of previous crops).

Avoid wounds during harvest and post-harvest processing





Acknowledgments

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