Growing Chickpea in Eastern Africa

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Growing Chickpea in Eastern Africa

ICRISAT

International Crops Research Institute for the Semi-Arid Tropics
Patancheru, Andhra Pradesh 502 324, India

1991

This booklet has been produced jointly by the Agricultural Research Corporation (ARC), Sudan; Kenya Agricultural Research Institute (KARI), Kenya; Alemaya University of Agriculture (AUA), Ethiopia; International Center for Agricultural Research in the Dry Areas (ICARDA), Syria; and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India. The objective is to help researchers, extension workers, and farmers not only to grow a good crop of chickpea, but to spot, diagnose, and, it is hoped, control the problems that may occur during the crop cycle from seed for sowing to seed for storing.

We hope it will be helpful. If you have questions or suggestions about how the booklet can be improved, please write to one of the sponsoring institutions. We will be pleased to hear from you.

And we wish you success in growing chickpeas!

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Introduction

Chickpeas are grown in several countries in eastern Africa. The area covered by the crop and its productivity are shown in Table 1.

Table 1. Areas under chickpea and its productivity in 1987 for African countries and the world.

Country	Area (in 1000 ha)	Productivity (kg/ha)
Algeria	65	291
Egypt	10	1633
Ethiopia	180	667
Libya	1	712
Malawi	33	667
Morocco	85	588
Sudan	2	1067
Tanzania	32	344
Tunisia	40	800
Uganda	10	800
Africa	457	613
World	9937	691

Source: FAO Production Yearbook 1987.

The yields are rather low and can be much higher if the effect of adverse conditions is reduced. In the following pages, major problems are discussed, and action to help solve them is indicated. If constraints are caused by living organisms, they are described as "biotic"; others caused, for instance, by drought and heat are termed "abiotic".

Illustrations of Chickpea Farms

Fig. 1. In Ethiopia.

Fig. 2. In Kenya.

Fig. 3. In Sudan.

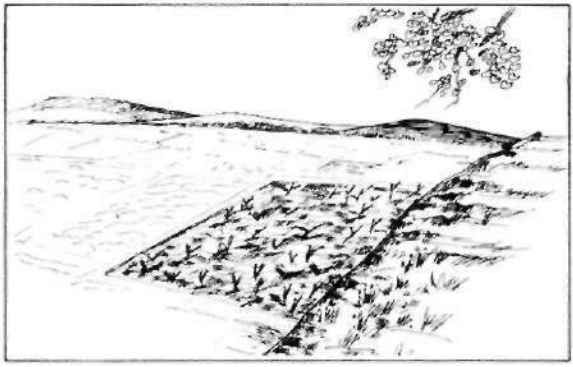
Abiotic Constraints from Sowing to Harvest

Seedbed

A good seedbed has a fine, loose tilth. It is well drained and free from stubble and debris from a previous crop, because such residues cause a disease called collar rot (see below). A crop rotation of 3 years is recommended.

Sowing

The seed needs to be of good quality. If there is doubt about its quality, take 50 seeds, put them between clean towels, keep them moist at room temperature, and inspect them after 3 days. If the roots have not emerged, wait for 2 more days. If less than 40 seeds have germinated at that time, you may need better seed. Otherwise, adjust the seed rate (Table 2).



Diag 1. A chickpea seedbed: with stubble (above) and without stubble (below).

Fig. 4. Good germination.

Table 2. Germination seed rates.

How many seeds germinated out of 50?	Extra seed required
50	normal
48	5% more
46	10% more
44	15% more
42	20% more
40	25% more

If there has never been a chickpea crop in the same field, the seeds need to be inoculated with *Rhizobium.* The local extension service may be asked to help (see below).

If the land is fertile, fertilizers may not be required. Otherwise, better yields can be produced by applying nitrogen and phosphorous fertilizer. Seek advice from the local extension service.

Fig. 5. Poor germination.

Fig. 6. Good nodulation.

Fig. 7. Poor nodulation.

Diag 2. Fertilizer application.

Establishing a good plant stand is very important. Often we recommend a density of 30 plants per m^2. This can be obtained by spacing rows 30 cm apart and placing seeds every 10 cm within the row. Table 3 shows the seed required for 1 ha, depending on the size of the seeds.

Table 3. Seed rates for 1 ha.

Weight of 100 seeds (in grams)	Seed to sow (in kg/ha)
10	33
15	50
20	66
25	83
30	99
35	116
40	132
45	149
50	165
55	182
60	198
65	215

If the quality of the seed is not perfect, the seed rate needs to be adjusted. If, for example, only 80% of the seeds germinate, the seed rate has to be $\frac{100}{80} \times$ the rate given in Table 3.

Fig. 8. Good plant stand.

Fig. 9. A poor plant stand.

Question: If the germination you find on a moist towel is 83%, and the weight of 100 seeds is 30 g, how much seed do you need to sow per hectare?

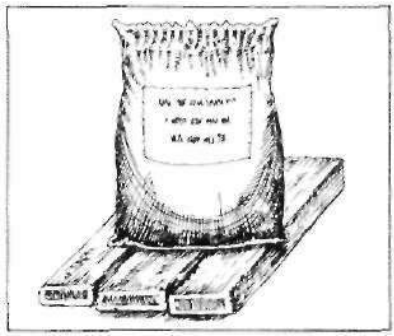
Answer: $\frac{100}{83}$ x 99 kg = 120 kg.

The seed needs to be sown deep enough to make contact with moist soil. Pressing the soil with a roller or with planks after sowing the seed also helps the seeds to germinate well.

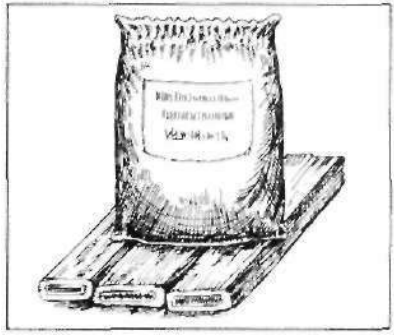
Crop Growth

Once the seedlings have emerged, the crop will establish itself. Then growth will depend on many factors that cannot be controlled, such as sunlight and temperature. Depending on the type of soil, harrowing may be useful after rainfall has compacted the land.

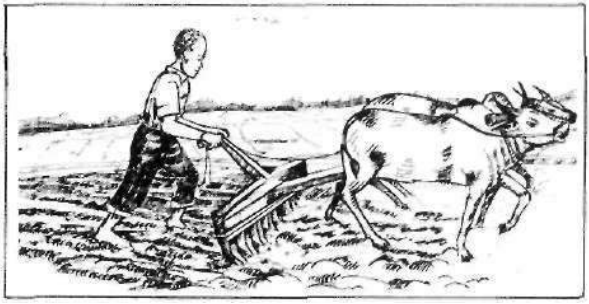
Fig. 10. A germinated seed.



Diag 3. Germination at 100%.



Diag 4. Germination at 83%.



Diag 5. Harrowing.

If irrigation facilities are available, at least the water requirement of the crop can be satisfied. We do not need to go into detail regarding drought problems. They are well known! But there are two disorders discussed below that can be treated.

Iron chlorosis

Cause: Restriction in uptake of iron ions: for instance, because of waterlogging.

Symptoms:
* Bright yellowing of plants, especially at the top.
* Some stunting.
* Brown discoloration and even death if iron deficiency is severe.

Control: When symptoms appear, we recommend foliar application of 5 grams ferrous sulphate in 1 L of water, together with 1 mL of liquid soap (e.g., Teepol) as a sticker. About 600-700 L of the solution is required for each hectare. Use resistant varieties.

Fig. 11. Drought problems.

Figs. 12 and 13. Iron chlorosis symptoms: bright yellow coloration (left); stunting (right).

Fig. 14. Severe symptoms of iron chlorosis.

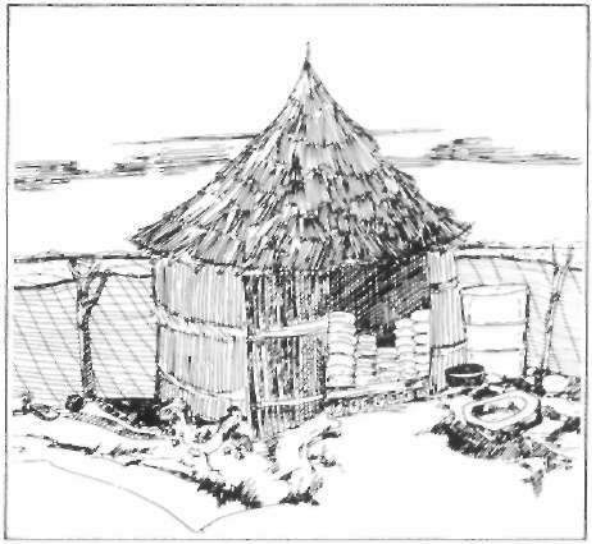
Salinity injury

Cause: Saline condition of the soil.
Symptoms: * Stunted growth.
* Yellow-brown leaf margins.
Control: Land reclamation; judicious irrigation.

At Maturity

At the time of crop maturity it is best to harvest and thresh as soon as possible. No crop produce is safer than in the bag. There might be danger of rain, wind, fire, or even theft if the crop is left unnecessarily long in the field. Healthy, dry storage is important to maintain the good quality of the seed.

Figs. 15 and 16. Salinity injury: stunted growth (left); yellow-brown leaf margins (right).



Diag 6. Seeds stored in bags.

Biotic Constraints from Sowing to Harvest

Seedbed

Chickpea seedlings are not very robust, and competition with weeds needs to be prevented. Therefore, keep the seedbed free from weeds.

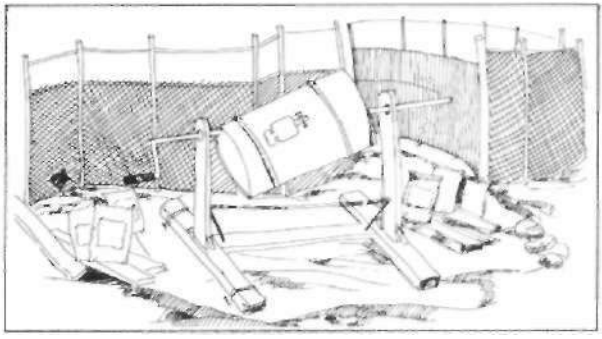
Sowing

If the seed is of good quality, and the conditions for germination are satisfactory, there is no need to treat the seed with afungicide. But if theseeds have been harvested and stored under humid conditions, it is advisable to treat them with BenlateToranother recommended safe protectant before sowing. Always follow the instructions given by the manufacturer.

Seeds can be coated with *Rhizobium* using a mixture of 70 grams of peat inoculum (contains 1 billion rhizobia per gram of inoculant) in 300 mL of 10% jaggery solution (1 kg sugar cane extract : 9 L water). This quantity is sufficient to treat 20 kg seed. The slurry is poured on the seeds placed in a plastic container, which is then shaken to thoroughly mix the contents. Treated seeds are dried in the shade and sown as soon as possible thereafter.

Fig. 17. A weed-free field.

Fig. 18. A field with many weeds.



Diag 7. Seed treatment.

If you are in doubt about the necessity of inoculation, it is better to apply *Rhizobium* rather than to risk poor nodulation if the inoculum is readily available. However, we recommend that small-scale experimentation be done, with treatments for the presence and absence of rhizobial inoculation, to test the necessity of inoculation at a particular site.

It can happen that rodents dig out chickpea seeds or seedlings. Cutworm can also damage the emerging crop and reduce the stand. Rodent and cutworm bait should be placed in the field if damage becomes severe.

Crop Growth

It is a fine sight to see the chickpea seedlings emerge 4-6 days after sowing, but soon thereafter it is sensible to prepare for trouble. Occasionally it happens that birds eat the very young seedlings. Scare them away!

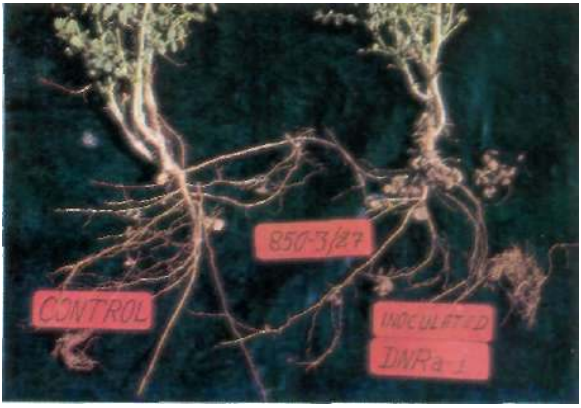


Fig. 19. Rhizobium inoculation: poor (left) and good nodulation (right).

Fig. 20. Seedling emergence.

Diag 8. Bird damage.

During the growth of the crop, many diseases and some pests can be harmful or even destructive. Some normally appear early, e.g., collar rot, others later, but often they are a threat throughout the cropping season.

At the beginning of the cropping season, a few wilting plants can always be seen. Often, the cause is collar rot.

Collar rot

Cause: *Sclerotium rolfsii,* a fungus.

Symptoms:
* Plants yellow.
* The collar region is constricted, it rots, and there are mycelial strands.
* There are sclerotia in the mycelium.

Control: Remove stubble and other plant debris from the field.

Later, a host of plant parasites may occur that affect the chickpea crop. The most important are the following.

Fig. 21. Collar rot: plants yellow.

Figs. 22 and 23: Other collar-rot symptoms: constriction at the collar region (left) and sclerotia in mycelium (below).

Fusarium wilt

Cause: *Fusarium oxysporum* f.sp *ciceri,* a fungus.

Symptoms: * Seedling collapses; internal tissue from the collar region downwards becomes dark and discolored.
* Adult plant wilts with drooping petioles and rachis.
* The central inner portion of the plant around the collar region changes color to brown or black.

Control: Use resistant varieties and rotate crops.

Dry root rot

Cause: *Rhizoctonia bataticola,* a fungus.

Symptoms: * Drying, straw-colored whole plants scattered in the field.
* Brittle roots, with no or only a few lateral roots.
* Minute sclerotia on exposed wood of roots and on the inner side of the bark.

Control: Use resistant varieties and rotate crops.

Fig. 24. Seedling collapse caused by fusarium wilt (left). Fusarium wilt: adult plants with drooping petioles (inset). Fusarium wilt: the central part (right).

Fig. 25. Field with dry root rot plants, sclerotia on bark (inset).

Figs. 26and27. Dry root rot: symptoms on an adult plant (left); and on roots (right).

Black root rot

Cause: *Rhizoctonia solani,* a fungus.

Symptoms: * Plants yellow, and petioles and leaflets droop.
* There are dark brown lesions above the collar region.
* Roots turn black and rot.

Control: Improve the drainage and use resistant varieties.

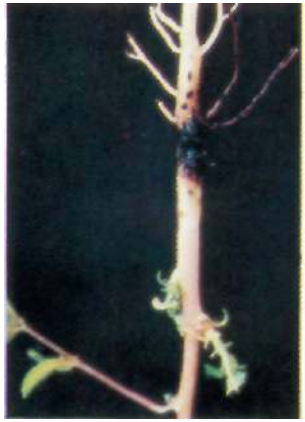
Stunt

Cause: Bean leaf roll virus.

Symptoms: * Stunted growth; short internodes.
* Yellow, orange, or brown discoloration of leaflets, which are reduced in size, and stiff.
* Phloem browning.

Control: Use resistant varieties.

There are recent indications that more than one virus may be involved in what we call stunt.



Figs. 28 and 29. Black root rot: lesions above the collar region (left) and root rotting (right).

Fig. 30. Stunted growth.

Figs. 31 and 32. Stunt: discolored leaflets (left) and phloem browning (right).

Root knot

Cause: *Meloidogyne* spp (*M. incognita and M. javanica),* nematodes.

Symptoms: * Variable crop growth.
* Infected plants are stunted, yellowish, and low-yielding.
* Knots (galls) appear on root systems.

Control: Rotate crops and use resistant varieties.

Additionally, much damage can be doneto chickpea plants by the following insect.

Pod borer

Cause: *Helicoverpa* sp (usually *armigera),* an insect pest.

Symptoms: * Tiny white eggs on the leaves, laid by a moth that flies at night.
* Green, yellow, or dark-colored larvae eat leaves, flowers, and especially seeds, for which they bore into the pods.

Control: Use resistant varieties. Manipulate the planting date if feasible to escape pest damage; also, if possible intercrop with nonhost plants. Spray with endosulfan and other recommended safe chemicals, using rates and methods as indicated by the manufacturer.

Fig. 33. Root knots.

Figs. 34 and 35. Helicoverpa *eggs (right) and the adult moth (below).*

Figs. 36 and 37. Helicoverpa armigera *larva and pupa (inset).*

Notes

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