

Farmers' Guide to Cowpea Production in West Africa

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Cover: A group of farmers discussing cowpea production with extension personnel.

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Introduction

The importance of cowpea

Cowpea is a major staple food crop in sub-Saharan Africa, especially in the dry savanna regions of West Africa. The seeds are a major source of plant proteins and vitamins for man, feed for animals, and also a source of cash income. The young leaves and immature pods are eaten as vegetables.

There is a big market for the sale of cowpea grain and fodder in West Africa. In Nigeria, farmers who cut and store cowpea fodder for sale at the peak of the dry season have been found to increase their annual income by 25%. Cowpea also plays an important role in providing soil nitrogen to cereal crops (such as maize, millet, and sorghum) when grown in rotation, especially in areas where poor soil fertility is a problem. It does not require a high rate of nitrogen fertilization; its roots have nodules in which soil bacteria called *Rhizobia* help to fix nitrogen from the air.

This guide draws its lessons from the work and experience of IITA and partners in Research for development on cowpea-based systems in West Africa. The handbook is intended to help farmers, extension personnel, and researchers in Nigeria, Niger, Mali, and other countries in West Africa, to grow cowpea profitably.

Climatic and soil requirements

Cowpea can be grown under rainfed conditions as well as by using irrigation or residual moisture along river or lake flood plains during the dry season, provided that the range of minimum and maximum temperatures is between 28 and 30°C (night and day) during the growing season. Cowpea performs well in agroecological zones where the rainfall range is between 500 and 1200 mm/year. However, with the development of extra-early and early maturing cowpea varieties, the crop can thrive in the Sahel where the rainfall is less than 500 mm/year. It is tolerant of drought and well adapted to sandy and poor soils. However, best yields are obtained in well-drained sandy loam to clay loam soils with the pH between 6 and 7.

Important steps in growing cowpea

Site selection

Proper site selection is very important. Select a well-drained sandy loam soil for rainfed cowpea, or inland depressions and along the shores of a lake for dry season cowpea using residual moisture. Cowpea does not tolerate excessively wet conditions or waterlogging and should not be grown on poorly drained soil.

Choice of varieties

Select a variety suited to your agroecological zone, based on suitability for the prevalent climatic conditions and cropping systems. The choice of variety is based on maturity period, yield potential, drought tolerance, responsiveness to daylength, and pest and disease resistance. Table 1 shows some of the important issues to consider when selecting a cowpea variety for a particular environment. The color and size of the seeds are very important to consumers and farmers. These, however, vary with regions. Some regions have a strong preference for brown, large-seeded varieties, while others prefer white seeds. Selected cowpea varieties recommended for Nigeria, Niger, and Mali are presented in Tables 2 to 4.

Table 1. Criteria in selecting a cowpea variety for a particular environment.

Production limitation	Variety to use
Drought	Drought tolerant and early maturing
Heat	Heat tolerant
<i>Striga</i> infestation	<i>Striga</i> resistant
Short rainfall (300–500 mm/year)	Extra-early and early maturing (Look out for the varieties that have a maturity period that falls within 60–80 days.)
Pests and diseases	Resistant to some major pests and diseases

Table 2. Cowpea varieties recommended for Nigeria.

Variety	Yield (t/ha)	Seed size	Seed coat texture	Growth habit	Maturity	Reaction to <i>Striga</i>	Other qualities
IT84S-2246-4	1.3	M	BR	Erect	Early	S	Moderately resistant to pests and diseases
IT90K-82-2	1.5	M	BR	Erect	Early	R	Moderately resistant to insects, pests, and diseases; good for the dry season.
IT97K-568-18	1.4–2.0	M	BR	Erect	Early	S	High yielding
Ife Brown	0.8–1.0	M	BR	Semi-erect	Medium	S	High yielding
IT89KD-288	1.0–1.2	L	WR	Semi-erect	Medium	S	Excellent for relayng with cereals
IT90K-277-2	1.5	S	WR	Semi-erect	Medium	S	Some level of resistance to aphids, thrips, bruchids, viruses, and several diseases
IT93K-452-1	1.2	S	WR	Erect	Extra-early	S	Resistant to insects and diseases, high fodder yield, good for double cropping.
IT97K-499-35	1.6	M	WR	Semi-erect	Medium	R	Resistant to insects and diseases, high grain and fodder yields.

M = medium, L = large, S = small, BR = brown rough, WR = white rough, CR = cream rough, R = resistant, S = susceptible
Maturity periods: Extra-early = 60–69 days, Early = 70–79 days, Medium = 80–89 days, Late = 90–120 days

Table 3. Cowpea varieties recommended for Niger Republic.

	Yield (t/ha)	Seed size	Seed coat texture	Growth habit	Maturity	Reaction to <i>Striga</i>	Other qualities
TN-5-78	1.5	S	BR	Semi-erect	Medium	S	Photosensitive
KVX-30-309-66	1.6	L	WR	Semi-erect	Medium	S	Photosensitive
IT89KD-374-57	1.7	M	WR	Semi-erect	Medium	S	High fodder
IT90K-372-1-2	1.7	M	WR	Semi-erect	Medium	S	High fodder
IT97K-499-35	1.6	M	WR	Semi-erect	Medium	R	Dual-purpose
IT97K-499-38	1.7	M	WR	Semi-erect	Early	R	High fodder
IT98K-205-8	1.4	M	WR	Semi-erect	Early	R	Dual-purpose

M = medium, L = large, S = small, BR = brown rough, BS = brown smooth, WR = white rough, CR = cream rough, R = resistant, S = susceptible

Table 4. Cowpea varieties recommended for Republic of Mali.

Variety	Yield (t/ha)	Seed size	Seed coat texture	Growth habit	Maturity	Reaction to <i>Striga</i>	Other qualities
IT89KD-374 (Korobalen)	1.5	Medium	WR	Semiprostrate	Early	R	Drought tolerant
IT89KD-245 (Sangaraka)	1.5-2.0	Large	WR	Prostrate	Medium	R	Cause suicidal germination of <i>Striga hermonthica</i>
IT93K-876-12	1.5	Medium	WR	Semi-erect	Medium	R	Drought tolerant
IT93K-876-30	1.5	Medium	WR	Semi-erect	Early	R	Drought tolerant
IT90K-372-1-2	1.5	Medium	WR	Semi-erect	Early	R	Drought tolerant
CZ1-94-23-1	1.5	Medium	WR	Semi-erect	Medium	R	Drought tolerant
CZ1-94-23-2	1.5	Medium	WR	Semi-erect	Medium	R	Drought tolerant
CZ11-94-5C	1.5	Medium	RR	Semi-erect	Early	R	Drought tolerant
KPR1-96-73	1.5-2.0	Large	WR	Prostrate	Medium	R	Drought tolerant
KPR1-96-32	1.5-2.0	Large	WR	Prostrate	Medium	R	Drought tolerant
KPR1-96-54	1.5-2.0	Large	WR	Prostrate	Medium	R	Drought tolerant
PBL22	1.5-2.0	Medium	WR	Prostrate	Late	S	Drought susceptible
PBL112	1.5-2.0	Medium	WR	Prostrate	Late	S	Drought susceptible
PRL73	1.5-2.0	Large	BR	Prostrate	Late	S	Drought susceptible
Suvita -2	1.5-2.0	Medium	BS	Semiprostrate	Medium	R	Drought tolerant

BR = brown rough, BS = brown smooth, WR = white rough, CR = cream rough, R = resistant S = susceptible.

Preplanting

Land preparation

Clear the site of shrubs and stubble. Alternatively, spray the field with Glyphosate (Round-up) at the rate of 4 L/ha (about 2 1/3 milk tins of chemical in a 15-L sprayer or 3 milk tins of chemical in a 20-L knapsack sprayer) to kill emerged weeds. Land can also be prepared manually with the African hand-hoe. Plow and harrow the field to provide sufficient tillth for good root growth. Make ridges thereafter if desired. Where the soils are more fragile and prone to erosion, adopt minimum or zero tillage.

Seed requirement

Use about 12–25 kg/ha of cowpea seeds, depending on the variety, seed size, cropping system, and viability of the seeds. More seeds are

Table 5. Seed rate/ha based on recommended plant spacing.

Cowpea type	Maturity	Spacing (cm)	Quantity of seeds/ha
Erect	Extra-early	50 × 20	25 kg (10 <i>mudus</i>)
Semi-erect	Early/medium	75 × 20	20 kg (8 <i>mudus</i>)
Prostrate (creeping)	Medium/late	75 × 30	16 kg (7 <i>mudus</i>)
Prostrate	Late	75 × 50	12 kg (5 <i>mudus</i>)

required when erect varieties are used than when prostrate varieties are adopted, because of the closer spacing of the erect variety. Also, fewer seeds are required when the cowpea is to be grown in mixture with other crops. The larger the seeds, the more seeds/ha are required. Table 5 shows the seed rate/ha for the different cowpea types.

Seed preparation for planting

Select good seeds (Fig. 1a) without damage holes or wrinkles (Fig. 1b) for planting.

Presowing seed dressing

Treat seeds before sowing with Benomyl (50%) or Carbendazine, Captan, or Thiram at the rate of 3 g/kg (1 sachet) of seeds, or with Apron Plus at the rate of 10 g/4–5 kg of seeds (1 sachet), or Apron Star 42 WS at the rate of 10 g/8 kg of seeds/1 sachet. This will enhance good germination and protect the seedlings from insect and fungal infection soon after emergence.

Figure 1a. Good seeds.



Figure 1b. Bad seeds.



Table 6. Rainfall duration and planting dates.

Commencement of rains	Duration	Cowpea type	When to plant cowpea
May	May–October	Erect (early and extra-early maturity)	August, week 2
		Semi-erect (medium maturity)	August, week 1
		Prostrate (late)	August, week 2 (needs dew)
June	June–October	Erect (early and extra-early maturity)	August, week 3
		Semi-erect (medium maturity)	1 August, week 1
		Prostrate (late)	Mid-August (needs dew)
June/July	July–October	Erect (early and extra-early maturity)	End of July
		Semi-erect (medium maturity)	End of July
		Prostrate (late)	August, week 1 (needs dew)

Planting

When to plant

When establishing a cowpea farm, do not plant too early so that the crop does not mature during the rains, and also do not plant too late to avoid the danger of an early end to the rains. The important criterion is to determine the onset and duration of the rains and, more importantly, the maturity period of the cowpea variety. This will guide you on when to establish your cowpea farm. Most of the semi-erect and prostrate varieties are photosensitive. When planted early, they will not flower but grow very leafy and yield may be reduced. Table 6 highlights some of the planting dates recommended in your locality.

Sowing and spacing for sole cowpea

Erect cowpea varieties should be planted at a spacing of 50 cm between rows and 20 cm within rows, especially for extra-early maturing varieties (60–70 days). For semi-erect varieties, spacing should be 75 cm between rows and 25–30 cm within rows. For prostrate varieties, plant at a spacing of 75 cm between rows and 50 cm within rows. For all recommended plant spacings, sow 3 seeds/hill and thin to 2 plants/stand at 2 weeks after planting. Cowpea should be planted either on ridges or on flat beds, depending upon the field preparation. Planting is usually manual, since mechanical planters are not readily available.



Figure 2a. Maize + cowpea strip intercropping.



Figure 2b. Cowpea relayed into maize.

Sowing and spacing for cowpea + cereal mixture

Where cowpea is to be intercropped or relayed with other crops, such as maize, the spacing should be 75 cm × 50 cm (Figs 2a and 2b). Also the cowpea should be planted at about 4–6 weeks after planting the first crop, maize, sorghum, or millet. For strip intercropping, adopt 2 rows of cereal to 4 rows of cowpea to improve the productivity of erect and shade-sensitive cowpea varieties. The cereal and cowpea should be planted at the recommended spacing.

Sowing depth

Sow seeds at a depth of 2.5 to 5 cm for most varieties; planting seeds more than 5 cm deep will delay emergence. The seeds may rot and plant stand will be uneven.

Fertilizer rate and application

Cowpea does not require too much nitrogen fertilizer because it fixes its own nitrogen from the air using the nodules in its roots. However, in areas where soils are poor in nitrogen, there is a need to apply a small quantity of about 15 kg of nitrogen as a starter dose for a good crop. If too much nitrogen fertilizer is used, the plant will grow luxuriantly with poor grain yield. Cowpea requires more phosphorus than nitrogen in the form of single super phosphate or SUPA. About 30 kg of P/ha in the form of Supa is recommended for cowpea production to help the crop to nodulate well and fix its own nitrogen from the air. Table 7 presents the recommended rate of fertilizer for cowpea production.

Table 7. Recommended fertilizer rate for cowpea.

Fertilizer nutrient/ha	Quantity equivalent in bags/ha	Time of application	Remarks
15 kg N	2 bags of compound fertilizer (NPK 15:15:15)	Apply during land preparation or at planting by incorporating into the soil	This will also supply 15 kg each of nitrogen, phosphorus, and potassium.
30 kg SUPA	2 bags of single super phosphate (SUPA)	Same as above	This will supply 18 kg of phosphorus.

Weed control

Weeds are a serious problem in cowpea production and, if not well managed, can harbor pests and reduce both the yield and the quality of the grain. Fodder yield can also be reduced. Cowpea is not a strong competitor with weed, especially at the early stage of growth. The type of weed control measures adopted should be based on the nature of the problem and the resources available to the farmer. Weed control in cowpea could be during preplanting and either manual or chemical.

Preplanting weed control/zero tillage

Spray with Glyphosate where there are troublesome weeds such as sedges and speargrass or when minimum/zero tillage practices are desired. Glyphosate kills the weeds right from the roots and thus allows the farmer to prepare the field or plant the crop without the fear of the troublesome weeds emerging within the same season. Glyphosate is marketed in different brand names, such as Glycel, Force Up, Round Up, Delsate, Uproot, Sarosate, Touchdown, Clearweed, Killoff, Bushfire, etc.

Manual weed control: Manual weed control is the most common method used by farmers in cowpea production. Weed cowpea twice with the hoe, first at 2 weeks after planting, and secondly at 4–5 weeks after planting to ensure a clean field. Poor weed control or delay in weeding causes a drastic reduction in yield.

Chemical weed control: Herbicides, if used properly, are safe and effective in controlling weeds in cowpea. The choice of herbicide, however, depends on the predominant weed species and the availability

of the herbicide. If herbicide is used at planting, one hoe weeding may be required at 4–5 weeks after planting. Application of a tank mixture of Paraquat and Pendimethalin within 2 days of planting is recommended. Paraquat controls emerged grass and broadleaf weeds while Pendimethalin prevents weed seeds from germinating. Table 8 shows the recommended herbicides and the dosage rate. Do not apply herbicides that are not recommended to cowpea to avoid damage to the plant.

Parasitic weeds: The two types of parasitic weeds that attack cowpea are *Striga* (Fig. 3) and *Alectra* (Fig. 4) but *Striga* has a more devastating effect than *Alectra*. *Striga gesnerioides* is widespread in areas with low rainfall and poor soil fertility, conditions that are common throughout the northern Guinea and Sudan savanna zones. It causes yellowing between the veins of cowpea leaves, resulting in the death of infested plants. The problem becomes worse when soil moisture is limiting.

The seeds of these parasites can survive in soil for many years (more than 20 years) until a susceptible variety is planted. Cultural control measures that are affordable to farmers include cowpea–cereal rotation and the use of resistant cowpea varieties.



Figure 3. *Striga gesnerioides* parasitizing cowpea.

Figure 4. *Alectra vogelii* parasitizing cowpea.



Table 8. Recommended herbicide for weed control in cowpea.

Product trade name	Brand or common name	Quantity/ha	Quantity/ sprayer load	Condition of use	Remarks
Glyphosate (for total weed control)	Round-up, Kill-off, Touch-down, Delsate, Sarosate, Glycel, Force-up, Clearweed, Desensate, Glyphosate, Rhonasate, etc.	4 L	350 ml in 15-L or 450 mL in 20-L knapsack sprayer.	Apply on emerged weeds before land preparation.	Wait for 14 days after application before preparing the land and plant with or without land preparation.
Paraquat plus Pendimethalin (500EC) (for emerged weeds and preemergent weed seed control).	Same as above	3 L of Paraquat plus 3 L of Pendimethalin	250 mL Paraquat plus 250 mL Pendimethalin in 15- L sprayer or 350 mL of Paraquat plus 350 mL of Pendimethalin in 20-L sprayer.	As above	Apply within 2 days after planting.
Paraquat plus Dual Gold (for emerged weeds and preemergent weed seed control)	Paraquat: same as above Dual Gold: Galex	3 L of Paraquat plus 2 L of Dual Gold	250 mL Paraquat plus 200 mL Dual Gold in 15-L sprayer or 350 ml Paraquat plus 250 mL Dual Gold in 20-L sprayer.	Same above	Apply within 2 days after planting.
Paraquat plus Butachlor (as above)	Paraquat: same as above Butachlor: Teer, Butaforce, Butaclear, Butacrop, Butarice, Risene, Butacot, etc.	3 L of Paraquat plus 4 L of Butachlor	250 ml Paraquat plus 350 mL Butachlor in 15-L sprayer or 350 mL Paraquat plus 450 mL Butachlor in 20-L sprayer.	Same as above	Apply within 2 days after planting.

Cowpea diseases and their control

Fungal, bacterial and viral diseases affect cowpea. Different diseases affect different parts of the crop at different stages of growth. The major and common diseases are anthracnose, *Sclerotium* stem, root and crown rot, damping off, *Cercospora* leaf spot, *Septoria* leaf spot, *Fusarium* wilt, and scab.

Control measures include:

- Adopt crop rotation.
- Use clean seeds.
- Dress seeds before planting (Apron Star).
- Use a resistant variety.
- Uproot and bury infected plants.
- Plow contaminated topsoil to reduce the incidence of pathogens.

Apply fungicide (Benomyl or Mancozeb) to leaves at the rate of one small matchbox-full in a 15-L sprayer.

Insect pests and their control

Insect pests are major constraints to cowpea production in West Africa. The crop is severely attacked at every stage of its growth by a myriad insects that

make the use of tolerant varieties and insecticide sprays imperative.

The level of insect attack increases from the southern Guinea savanna towards the Sahel savanna zone of the region. Damage by insect pests on cowpea can be as high as 80–100% if not effectively controlled.

Cowpea pests can be classified into three major groups: preflowering, flowering/postflowering, and storage. Some of the major and important pests of cowpea are discussed below.

Preflowering pests

Cowpea aphid (*Aphis craccivora*): The adult aphid is a medium-sized, shiny black insect. It not only causes direct damage to the cowpea plant but also acts as a vector in transmitting of *Cowpea aphid*-borne mosaic virus. The aphid damages young cowpea seedlings by sucking sap from the undersurface of young leaves and stem tissues, and on the pods of mature plants. The honeydew produced on the plant (Fig. 5) is evidence of aphids feeding on the crop.



Figure 5. Aphid sucking sap from cowpea pod.



Figure 6a. Thrips feeding on cowpea flower.

Figure 6b. Plant severely infested by thrips.



Flowering/ postflowering pests

Flower thrips

(Megalurothrips sjostedti
[Taeniothrips sjostedti])

They are frequently responsible for total crop loss. The adult thrips are very tiny black insects, and are found feeding on flower buds and flowers. Severely infested plants do not produce any flowers. When the population of thrips is very high, open flowers are distorted and discolored. Flower buds and flowers fall prematurely without forming any pod (Figs 6a and 6b).

Blister beetles

(Mylabris spp.)

They feed on cowpea flowers leading to considerable crop damage. Large numbers of beetles in a field may result in total crop loss. The adult beetles are attracted to maize pollen. Cowpea fields near to or intercropped with maize often suffer serious damage. It is difficult to control this pest with insecticide sprays

as the beetles feed on flowers that persist only for a day (Fig. 7).

Maruca pod borer (*Maruca testulalis*)

Maruca is widely distributed throughout the tropics and subtropics where it may cause extreme damage. The adult is a nocturnal moth, light brown with whitish markings on its forewings. The larvae feed on tender parts of the stem, peduncles, flower buds, flowers, and pods (Figs 8a and 8b).

Pod-sucking bugs (*Anoplocnemis curvipes*)

This is a major pest of cowpea in tropical Africa. Yield losses caused by *A. curvipes* vary from 30 to 70%. They suck the sap from green pods, causing them to shrivel and dry prematurely, resulting in seed loss. Clean up haulms from previous crops, as these insects may overseason in such rubbish. Plant resistant cowpea cultivars and spray with recommended insecticides (Figs 9a and 9b).



Figure 7. Blister beetle feeding on cowpea flower.



Figure 8a. *Maruca* larva feeding on cowpea flower.



Figure 8b. Pod damaged by *Maruca*.



Figure 9a. Pod bug sucking sap from cowpea pod.



Figure 9b. Pods severely damaged by pod-sucking bugs.

Insect pest control in the field

Generally, 2–3 sprays with insecticides are required for a good crop of cowpea, depending on the severity of insect attack and also on the cowpea variety. Late-maturing varieties require more sprays than early maturing varieties because of the staggered flowering period. Adopt the following spraying regime to control insects using any of the insecticides listed in Table 9.

First spraying: Conduct the first spraying between 30 and 35 days (4–5 weeks) after planting when flower bud initiation has started. This will control thrips and an early attack of *Maruca* pod borer and ensure good flowering (7–9 weeks). For varieties susceptible to aphids, one spraying may be needed at seedling stage, 14–21 days after planting.

Second spraying: Conduct the second spraying 10 days after the first spraying when the crop is in full flowering and podding.

Third spraying: Conduct the third spraying when necessary, 10 days after the second spraying for medium/late-maturing varieties and when there is a heavy attack of *Maruca* and pod bugs.

Table 9. Some recommended insecticides for control of insect pests in cowpea.

Product trade name	Brand or common name	Application rate	Estimate for one sprayer load	Condition of use	Remarks
Lamda-cyhalothrine 25 EC (insecticide).	Karate 2.5 EC, Karto 2.5 EC,	0.4–0.8 L/ha	35–70 mL in 15-L sprayer or 50–80 mL in 20-L sprayer	Contact and ingestion. Apply at early infestation and against early stages of insects' life cycle.	Controls leaf, fruit, and soil dwelling insects and migratory insect pests.
Perfekthion 2.5 EC (insecticide)	Dimethoate	0.5–0.8 L/ha	40–70 mL in 15-L sprayer or 50–80 mL in 20-L sprayer	Systemic action. Apply at early infestation and during early stages of insect life cycle.	Controls plant sucking insects.
Cyper-methrin plus Dimethoate (insecticide)	Best Action Cyperdiforce Superplus Sherpaplus Balathoate plus, Upper-cott, etc.	1 L/ha	75 mL in 15-L sprayer or 100 mL in 20-L sprayer	Contact and systemic action. Apply as above.	As above
Diafuran 3G (insecticide/nematicide)	Carbofuran	25–100 kg/ha	3 g/plant or 7–10 g/m ² of soil during seedbed preparation.	Contact, systemic, and ingestion. Apply on the soil to control foliar pests through systemic action in plants and to control nematodes.	Controls foliar and soil insects and nematodes.

Method of spraying insecticides

The most common methods of applying chemicals are the use of the following:

- Knapsack (high-volume) sprayers. Examples CP-3 or CP-15. SP 15, Dami 16D, Jacto 20/16.
- ULV (Ultra-low-volume) sprayer (with yellow nozzle). This could be adopted in areas where water is a serious problem, as in the Sahel savanna of West Africa.



Figure 10. Harvesting mature pods of IT90K 277–2.

- Apply any of the recommended insecticides early in the morning or late in the evening.
- Use a conical nozzle when spraying insecticides with knapsack sprayers.

Harvesting

Harvest cowpea when the pods are fully mature and dry (Fig. 10). In early-maturing and erect varieties, one picking may be sufficient. For indeterminate and prostrate varieties, the dried pods can be picked two or three times. The pods do not mature at the same time because of the staggered flowering period. After harvest, thresh the cowpea pods, clean the seeds, and separate them from the chaff or haulms through winnowing.

Postharvest

Storage

Clean out the store thoroughly before a new crop is loaded. Old residues should be burned. Only well-dried and properly cleaned seeds should be stored (Figs 11a and 11b).



Figure 11a. Cowpea seeds not properly cleaned.



Figure 11b. Properly cleaned cowpea seeds.

A well-dried cowpea seed should have less than 10% moisture content. Such seeds make a cracking sound when crushed between the teeth.

Storage pests and their control

The most important storage pest of cowpea is the weevil (bruchid) called *Callosobruchus maculatus*. Severe infestation can lead to total grain loss in storage. It is a field-to-store pest; adult beetles lay eggs on pods (in the field) or on seeds (in storage). After hatching, the larvae develop within seeds and eat up the cotyledon, thereby causing extensive damage. Adults emerge from the seeds through characteristic holes made by the larvae. The holes make it easy to recognize infested seeds (Fig.12). Adopt store hygiene and fumigation, and use airtight containers to control bruchids.

Short-time storage for grains

- Store the grains in airtight containers, such as sealed oil drums, locally constructed tanks, high-density plastic sacks or butyl rubber bags, or mix 5 mL of groundnut oil with 1 small *mudu* (1 kg) of grains.
- Store seeds by packing them into jute or polypropylene bags with polythene inner liners or by triple bagging.
- Keep rodents away.

Long-time storage for seeds and grains

- Fumigate with Dichlovos (DDVP) combined with Primophos methyl or Phosphine gas at the rate of 1–2 tablets/100 kg of seeds.
- Wrap the Phostoxin tablet in a piece of cloth or tissue paper or perforated envelope before placing it inside the container.
- Do not use Phostoxin directly without wrapping it or in a container that is not airtight.
- Aluminum phosphide is marketed as Phostoxin, Cyclotoxin, Forcetoxin, Protex, Gastoxin, etc.
- Do not store cowpea treated with Phostoxin in a living room or animal house.
- Remove and dispose of the Phostoxin residue and expose grains in the open air for 1–2 hours before use.
- Store seeds by packing them into jute or polypropylene bags with polythene inner liner or triple bagging, or mix 100–200 mL of Actellic 25 EC in 5 L of water and spray 100 m² of the store or 10 bags of grains, and/or mix 16–40 mL of Actellic 25 EC with 1–2 L of water and mix with 10 bags of grains.
- Do not use or sell cowpea grains that have been mixed with storage chemical until after 6 months of storage.
- Ensure good hygiene in the store and check every 2 weeks for any change in storage conditions.
- Keep rodents away.



Figure 12. Poorly stored cowpea seeds (damaged by weevil).

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