ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE
CGIAR
INITIATIVE ON
Sustainable Animal Productivity

ILRI Forage Factsheet

September 2023

Cowpea (*Vigna unguiculata*) for livestock feed

Uses of cowpea

Cowpea is a dual-purpose, fast-growing, annual legume suitable for grazing, hay/silage, grain or green manure. It is an excellent crop for fattening both sheep and cattle and is also regarded as good feed for milking cows. The seeds, pods and succulent leaves can be consumed as food.

In a crop rotation program, cowpea can significantly improve soil nitrogen levels by nitrogen fixation or by incorporation in the soil as a green manure crop.

Environmental adaptation

Cowpea is moderately drought-tolerant and fast-growing in areas with average annual rainfall as low as 500 mm. It is best grown in areas with annual rainfall between 750 and 1,100 mm (Madamba et al. 2006; Heuze and Tran. 2015).

Adapted to produce in a wide range of soils from sands to heavy, well-drained clays, cowpea has a preference for lighter soils that favour good root development (Sheahan 2012). It is commonly grown in heavy textured, strongly alkaline soils.

Cowpea does not tolerate extended flooding or salinity. It is tolerant to heat, but not to frost.

Strengths

Multi-purpose legume.

Easy to establish.

High nutritive value.

High palatability.

Adapted to a wide range of soils.

Drought-tolerant.

High yields in a short period of time.

Limitations

Must have well-drained soil.

Susceptible to several pests and diseases.

Sensitive to cold, heavy rainfall and frost.

Heavy grazing should be avoided.

Management

Field preparation: The field should be well drained and ploughed.

Establishment: Sow 10–15 kg/ha of good quality seed under dry land conditions and 20– 25 kg/ha in irrigated and higher rainfall areas. Cowpea is best sown 1–5 cm deep with good seed-soil contact into a well-prepared seedbed. Plant 2–3 seeds per hill and thin to one plant after seedling establishment.

Cowpea can be grown as an intercrop/mixture with forage sorghum, pearl millet or maize (Pitan and Odebiyi 2001).

Inoculant: Seed inoculation is not common as cowpea can nodulate in different soil types, but inoculation using a cowpea strain could be advantageous (Sheahan 2012).

Fertilizer: Cowpea is commonly grown without fertilizer applications but, when grown in less fertile soil, it may benefit from a one-time 100 kg per hectare application of diammonium phosphate (DAP) during planting to help root development.

Weeding: Hand weeding should be done twice within the first five weeks of growth.

Major pests and diseases: Cowpea is very susceptible to insect damage. The legume pod borer, *Maruca vitrata*, is the main preharvest pest of cowpea (Sharma 1998). Other important pests include pod sucking bugs, thrips, and the postharvest cowpea weevil, *Callosobruchus maculatus* (Jackai and Daoust 1986).

As field adaptation trials are meant to evaluate the performance of the cultivars to biotic and abiotic factors, it is recommended to avoid pesticide spray. If disease and pest infestation occurs, record the severity level/infestation damage, but if the whole field is affected, the trial site can be sprayed with a pertinent pesticide.

Common diseases that infest cowpea plants include blights, root rot, wilt, powdery mildew, root knot, rust and leaf spot. The plant is also susceptible to mosaic viruses (Olowe et al. 1987). To reduce disease occurrence, it is recommended to treat the seeds with seed dressing chemicals such as carbendazim or Apron star 42WS.

Harvesting: The ideal time to cut a cowpea crop for hay is at peak flowering, or about 7–8 weeks after sowing. Collect crop residue at mature grain stage i.e. after about 8–12 weeks (Cook et al. 2020). When seasons are suitable, the best forage types will regrow after grazing, but grazing should be light to ensure that the plant frame is retained and damage is limited.

Forage production

Cowpea produces biomass of about 3–10 t/ha dry matter in 8–12 weeks as crop residue at grain harvest.

Feed quality

Cowpea has a high nutritive value. Crude protein is 6–8% in the crop residue, 14–21% in green foliage, and 18–26% in grain. The *in vitro* dry matter digestibility (IVDMD) of foliage is >80% and of residues after grain harvest is 55–65% (Cook et al. 2020).

Seed production

Harvesting: Seeds should be ready to harvest 120–150 days after sowing. Harvesting should be done before the crop is too dry in order to avoid damage to the seed. The pods are mature enough to harvest once they have begun to turn yellow.

Drying: Plants should be left to dry under shade until the pods are brittle and the seeds become too hard to dent with a fingernail.

Threshing and cleaning: Threshing may be carried out in the field or on the threshing floor, by hand or with the help of animals or machines. Manual threshing is hand beating against an object. The seeds are breakable so the threshing should be light. Winnow the pods to separate the seeds and chaff. Traditional winnowing drops the dried grains from a height using shovels and a sieve.

Seed yield: Overall, yields are 100–4,000 kg/ha but are generally in the range of 200–600 kg/ha.

Storage and viability: Store cowpeas in a cool, dark and dry place in an airtight container to keep out moisture and humidity. Under these conditions, cowpea seeds will last 3–4 years.

Seed quality: The minimum seed quality standard required for cowpea seed is 70% germinable seeds, 98.6% purity and 6–8% moisture content.

Field trials to improve cowpea for fodder production

The ILRI forage genebank holds more than 600 cowpea accessions. Among these, several improved varieties have been developed and released for fodder production (Table 1).

Table 1. Released cowpea varieties

Variety name	Accession no.	DOI	Release year	Institute
Temesgen	12688	10.18730/FRJ59	2014	TARI
Melka	9334	10.18730/G7TNV	2018	EIAR
Adulala	9352	10.18730/G7V89	2018	EIAR
Moges	9329	10.18730/G7TFN	2022	EIAR
Morka	ILRI-IT83D-442		2022	OARI
Qophee	11114	10.18730/FQ1NB	2022	OARI

Source: Urgesa 2023.

In addition, promising accessions have been identified for both forage biomass and grain yield through field experimentation in Ethiopia (Table 2). Thus, the released cowpea varieties and promising accessions can be candidates for fodder evaluation and adaptation studies in different tropical environments with similar climatic and edaphic conditions in order to develop improved variety/ies in the shortest time possible.

Table 2. Promising cowpea accessions for forage biomass and grain yield identified through field evaluation at Bishoftu, Ethiopia

Accession	Trait	DOI
ILRI_9339	Forage	10.18730/G7TT*
ILRI_12655	Forage	10.18730/FRH2B
ILRI_12657	Forage	10.18730/FRH4D
ILRI_25335	Forage	10.18730/G48N5
ILRI_9654	Grain yield	10.18730/G7Z6R
ILRI_11989	Grain yield	10.18730/FQWVY
ILRI_12654	Grain yield	10.18730/FRH1A
ILRI_12726	Grain yield	10.18730/FRKFE

Source: Ongoing trial at ILRI, Bishoftu.

Field evaluation procedure

To test the local and wider adaptability and performance of cowpea varieties, a standardized field evaluation will help to collect reliable data for comparison among different agro-ecologies and determine genotype stability (Teshome et al. 2023). To evaluate released cultivars and promising accessions, a multilocation field trial can be conducted by comparing with a local cultivar (if available) and recently released commercial cultivar in 2–3 different /similar environments. To capture the performance in different growing seasons and climatic conditions, it is recommended that the trial is repeated for 2–3 years. A replicated field design such as randomized complete block design (RCBD) could be employed.

To get sufficient plant samples in each experimental unit, five rows each with 10 plants, can be planted

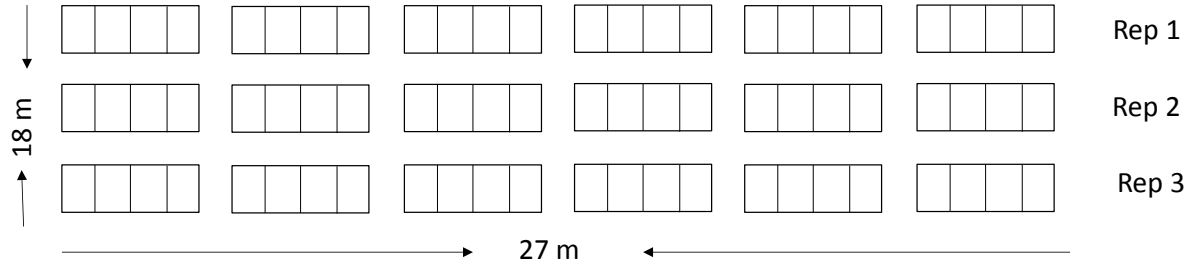
with spacing between plants and rows of 0.5 m and 0.75 m, respectively. The distance between experimental units (plots) can be set either to 0.75 m or 1 m and the distance between replications (blocks) can be set to 1.5 m or 2 m.

The field evaluation of cowpea can be done under rainfed conditions, without irrigation in the main rainy season, or using a controlled irrigation system such as drip irrigation in the dry season.

Field layout

Below is an illustration of a field layout for evaluation of four cultivars with two check varieties using RCBD in three replications.

Figure 1: Field layout of cowpea field evaluation.



Data collection

As cowpea is a dual-purpose crop, the traits collected for evaluation include both forage biomass and grain yield. To avoid border effects, sample only middle rows of the randomly selected and tagged plants (5–10) for morphological and agronomic data. Collect grain yield and yield components from 3–5 untagged separate plants in the middle rows.

Phenological data: Days to 50% flowering and days to maturity (90% pod maturity). Collect these on a plot basis.

Morphological data: Plant height, leaf length and width, canopy diameter and number of branches. Collect these traits at 50% flowering stage from 5–10 tagged plants.

Agronomic data: Record fresh and dry biomass yield immediately after 90% pod maturity from 5–10 tagged plants. Collect fresh yield immediately after harvest. For dry biomass yield, record the weight after drying samples in an oven at 70°C for 72 hours.

Grain yield data: Collect number of pods per plant, number of seeds per pod and pod length after 90% pod maturity from 3–5 separate untagged middle-row plants. Record grain yield at full maturity from another 3–5 untagged plants. Collect thousand seed weight by adjusting the seed moisture content to 12.5% from 100 randomly selected seeds and transforming the record to 1,000 seed weight.

Feed nutrition: After recording dry biomass yield, use the oven-dried samples for feed quality analysis such as Neutral detergent fiber , Acidic detergent fiber, Acidic detergent lignin, crude protein, digestibility (IVOMD) and metabolizable energy (Me).

Soil sampling: Collect a composite soil sample from each plot using an auger from a depth up to 30 cm before sowing and after completion of the trial. The samples will be analyzed in a soil laboratory for soil physio-chemical attributes.

References

Cook, B.G., Pengelly, B.C., Schultze-Kraft, R., Taylor, M, Burkart S., Cardoso Arango, J.A., González Guzmán, J.J., Cox, K., Jones, C. and Peters, M. 2020. Tropical forages: An interactive selection tool. 2nd and revised edition. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya. www.tropicalforages.info.

Heuzé, V. and Tran, G. 2015. Cowpea (*Vigna unguiculata*) seeds. Feedipedia, a programme by INRAE, CIRAD, AFZ and FAO. https://feedipedia.org/node/232.

Jackai, L.E.N. and Daoust, R.A. 1986. Insect pests of cowpeas. *Annual Review of Entomology*. 31: 95–119. doi: 10.1146/annurev.ento.31.1.95.

Madamba, R., Grubben, G.J.H., Asante, I.K., Akromah, R. 2006. *Vigna unguiculata* (L.) Walp. Record from PROTAbase. Brink, M. and Belay, G. (eds). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands.

Olowe, T., Dina, S.O., Oladiran, A.O. and Olunuga, B.A. 1987. The control of weed, pest and disease complexes in cowpea (*Vigna unguiculata* (L.) Walp.) by the application of pesticides singly and

in combination. *Crop Protection* 6(4): 222–225. doi:10.1016/0261-2194(87)90042-1.

Pitan, O.O.R and Odebiyi. J.A. 2001.The effect of intercropping with maize on the level of infestation and damage by pod-sucking bugs in cowpea. *Crop Protection* 20:5, 367-372.

Sharma, H.C. 1998. Bionomics, host plant resistance, and management of the legume pod borer, Maruca vitrata. *Crop Protection* 7(5): 373–386. doi:10.1016/s0261-2194(98)00045-3.

Sheahan, C.M. 2012. Plant guide for cowpea (*Vigna unguiculata*). USDA-Natural Resources conservation Service, Cape May Plant Materials Center, Cape May, NJ.

Teshome, A., Habte, E., Negawo, A.T., Shehabu, M.S., Assefa, Y. and Jones C.S. 2023. *Methods and practices for the evaluation of forage legumes, grasses and fodder trees for use as livestock feeds: Second edition*. ILRI Manual 64. Addis Ababa, Ethiopia: ILRI.

Urgesa, L. 2023. Review on cowpea production, utilization and research achievements in Ethiopia. *International Journal of Advanced Research in Biological Sciences* 10(1): 172–180. doi:10.22192/ijarbs.2023.10.01.014

Authors
Ermias Habte Meki Shehabu, Alemayehu Teressa, Abel Teshome and Chris Jones

Contact
Ermias Habte, Feed and Forage Development
ILRI Ethiopia
e.habte@cgiar.org

Photo credits
ILRI/Apollo Habtamu

Acknowledgements

This work was conducted as part of the CGIAR Initiative on Sustainable Animal Productivity for Livelihoods, Nutrition and Gender inclusion (SAPLING). CGIAR research is supported by contributions to the CGIAR Trust Fund. CGIAR is a global research partnership for a food-secure future dedicated to transforming food, land, and water systems in a climate crisis.