

Micro Doses, Mega Benefits

Promoting Fertilizer Use in Semi-Arid Zimbabwe



Micro Doses, Mega Benefits **Promoting Fertilizer Use** **in Semi-Arid Zimbabwe**

A manual for extension staff

compiled by

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INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS

Science with a human face

Micro Doses, Mega Benefits

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Foreword

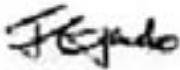
Soils in much of southern Africa have low inherent fertility. Crop production without supplementary fertilizers results in cereal yields of less than 500 kg per hectare, yields that always leave most households food insecure. Organic manures (compost, livestock manure) are some of the alternatives available to smallholder farmers. However, the quantities available are usually limiting. The use of mineral fertilizer by smallholder farmers, especially in the dry areas, is low. Farmers in these regions cite the high risk of crop failure due to recurrent droughts as the major reason for not investing in fertilizers. The use of blanket fertilizer recommendations that were largely developed for the wetter areas of the country has not helped matters as farmers have experienced 'burnt' crops in low rainfall years. As a result, less than 5% of farmers in the dry areas of southern and western Zimbabwe commonly use mineral fertilizers.

Due to the resultant low demand for fertilizer, most rural retailers in the dry areas do not stock mineral fertilizers. When available, the price is beyond the reach of most smallholder farmers. The result is that very few smallholder farmers in the dry areas of Zimbabwe and the region have had positive experiences with mineral fertilizers. There is need to promote and sustain fertilizer use by smallholder farmers of the semi-arid tropics (SAT) so that they increase their crop yields and household incomes.

The precise application of small quantities of inorganic nitrogen-based fertilizers, termed microdosing, is one strategy that can familiarize farmers in semi-arid areas with the benefits of applying fertilizer. The low rates of fertilizer used for microdosing are seen as a starting point. The yield and

economic benefits of using mineral fertilizers at these low rates have been amply demonstrated through farmer participatory adaptive trials involving more than 2000 farmers since 2001.

This manual is a product of six years of research and development work undertaken by the Department of Agricultural, Technical and Extension Services (AGRITEX), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and non-governmental organizations (NGOs) in many semi-arid districts of southern and western Zimbabwe. It is hoped that AGRITEX and NGO field officers will make use of this manual so that farmers in the SAT of Zimbabwe and the region can increase their crop yields and incomes through the use of mineral fertilizers.



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About this manual

This manual is for use by the Department of Agricultural, Technical and Extension Services (AGRITEX) and non-governmental organizations (NGOs) working in semi-arid areas. The procedures outlined in this manual are intended to supplement existing knowledge on fertilizer use. It outlines the first step in efficiently and effectively using nitrogen (N) fertilizer for cereal production in marginal areas with low and erratic rainfall such as Natural Regions III–V.

The first section gives a brief description of the biophysical and socioeconomic characteristics of agro-ecosystems in semi-arid Zimbabwe. The current fertilizer recommendations and perceptions of farmers to using fertilizers are highlighted in this section. The need for introducing microdosing as a first step towards getting farmers who do not normally apply fertilizer is outlined.

The second section deals with the development of the microdosing technology, its principles and practices. The practices are discussed with reference to the cereal crops that are commonly grown in semi-arid areas.

Results from on-farm testing of use of small quantities of N are highlighted in the third section of manual. Both short- and long-term benefits as well as constraints identified from field implementation are given in this section.

The last section suggests strategies to introduce and implement the use of small quantities of N fertilizer as a beginning to sustainable and adaptive use of fertilizers in semi-arid areas.

1. Introduction

1.1. Soil fertility and crop production in the smallholder systems

The soils of the traditional smallholder farming areas of Zimbabwe are predominantly sands to sandy loams. There is also the odd pocket of heavier textured soils, such as the red clay loams typically associated with former commercial farming areas of Natural Region II or humic soils found in the valley bottoms, e.g., vleis (Figure 1). The soils of semi-arid areas of southern Zimbabwe differ from those derived from similar parent materials in the higher rainfall areas of higher altitudes. The soils in semi-arid areas are less weathered and leached. They therefore have more weatherable minerals and available nutrients and less, but more active clays.

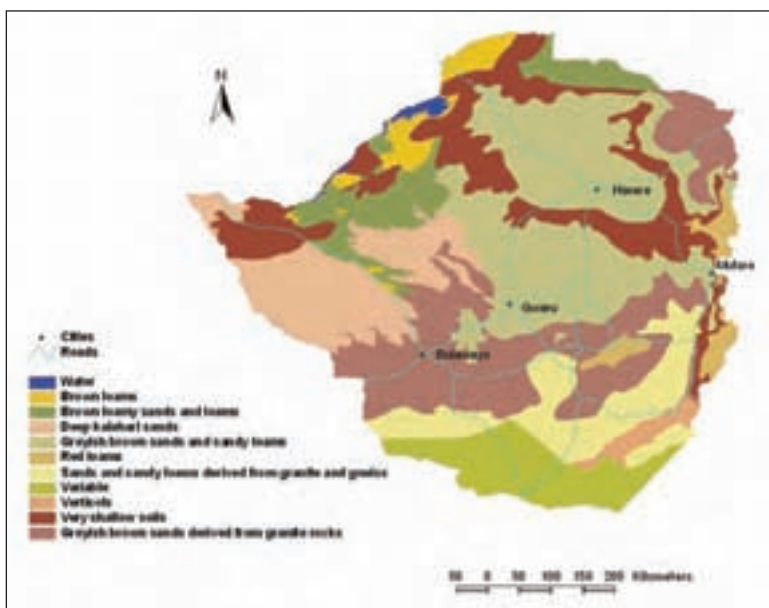


Figure 1. Soil map of Zimbabwe (FAO, 2006)

Much of the soil in Zimbabwe is coarse-grained sand with low water holding capacity and low nutrient exchange capacity. In such soils with little clay to stabilize the organic matter, the production of root mass is very important to hold the soils together. Additions of inorganic and organic fertilizers, particularly kraal manure, encourage plant growth, increasing root residues throughout the soil profile. Manure not only supplies nutrients for the growing plant, but also helps to ameliorate soil acidity. Wherever possible farmers should be encouraged to apply organic manures (kraal manure, compost) as the prime sources of nutrients for their crops, because they are usually available and contribute much to soil sustainability. Store-bought inorganic and organic fertilizers should only be used to supplement locally available organic manures. The amount, type, and quantity of organic and inorganic fertilizers to apply will depend upon the nutrients that are most limiting to the crop, the target yield, and, more importantly, economics.

In Zimbabwe, nitrogen (N) and phosphorus (P) have been identified as the nutrients most limiting maize, sorghum, and millet grain production. In fact, in much of semi-arid Zimbabwe, it is more often nutrient deficiency, rather than water stress, that is the primary factor limiting production. Food deficits occur in these areas in most seasons, as without external inputs the infertile coarse sands and unreliable and low rainfall will produce very little, typically 400 to 800 kg ha⁻¹, of the staple food crops.

To increase smallholder crop yields, manure and fertilizer must be applied at rates appropriate to the risk management strategy of the household. However, good basic crop management must not be neglected. Farmers must recognize the factors within their control that directly influence crop yields. Timely planting, correct spacing, fertilization and good



Right: A stunted and pale maize crop typical of the semi-arid areas of Zimbabwe. Left: Same maize crop with 17 kg of N.

water management all combine to increase yields, but will not compensate for poor weed, pest and disease management.

1.2. Current knowledge about fertilizer use in the dry areas of Zimbabwe

Existing fertilizer recommendations for the dry regions are generally based on responses from early planted crops, improved hybrids (or varieties). They mostly emanate, in a modified form, from the more reliable rainfall regions. These recommendations target optimal or maximal yield for an agro-climatic environment with reliable rainfall, and are generally quite high. Current extension messages promote the application of 150 to 300 kg of compound fertilizer and 100 kg to 200 kg of N fertilizer (ammonium nitrate) per hectare of maize. However, 95% of farmers fail to apply mineral fertilizers at all (see Table 1). The recommendations are also not being followed by the 5% who do apply inorganic fertilizer!

Table 1. Typical manure and fertilizer use in dry areas of Zimbabwe (unpublished data from ICRISAT-Bulawayo)

Type of fertilizer	Number of farmers using (%)	Farmer application rate	Recommended application rate
Manure	40	4 t ha ⁻¹	20–40 t ha ⁻¹
Inorganic fertilizer	5	50 kg ha ⁻¹	150–350 kg ha ⁻¹

The recommended levels of manure, at 15–30 t ha⁻¹, are impractical given that only 10% of households have enough animals to get this much manure. The other 40% of farmers apply between 2 and 4 t ha⁻¹ of manure to maize. In the case of inorganic fertilizers, the lack of uptake by smallholder farmers in semi-arid Zimbabwe is because poor farmers do not like the risk associated with the use of expensive fertilizer in low and unpredictable rainfall environments. Another factor is that fertilizer is rarely available in local retail outlets. The question is: *how can farmers get the highest returns from the fertilizer quantities they are able to purchase?* Answering this question is the basis of **Microdosing**.

2. Low Input Options – Microdosing

Before you proceed, please get the farmers to discuss

- fertilizer and manure use in their cropping,
- types of fertilizer (compound and N), and
- how and why they apply the fertilizers.

The underlying problem of existing fertilizer recommendations given to resource-poor farmers is illustrated in Figure 2. The recommendations are generally too high, being aimed at agro-climatic production optima that only the wealthiest farmers can afford. Farmers' application rates generally lie at the lower end of the response curve (Figure 2), reflecting:

- their limited resources to invest in fertilizer – most cannot afford more than a bag of AN fertilizer, and
- their risk management strategy – the highest marginal returns to applying N fertilizer are at the lower rates of application.

Farmers are likely to adopt lower rates in the first instance because they are more affordable. Also, farmers are not exposed to the risks of poor crop yields due to inadequate rainfall. These lower rates will increase the likelihood of positive results from farmer experimentation, thereby encouraging further investment in fertilizer. Farmers may move to higher application rates or purchase other types of fertilizer.

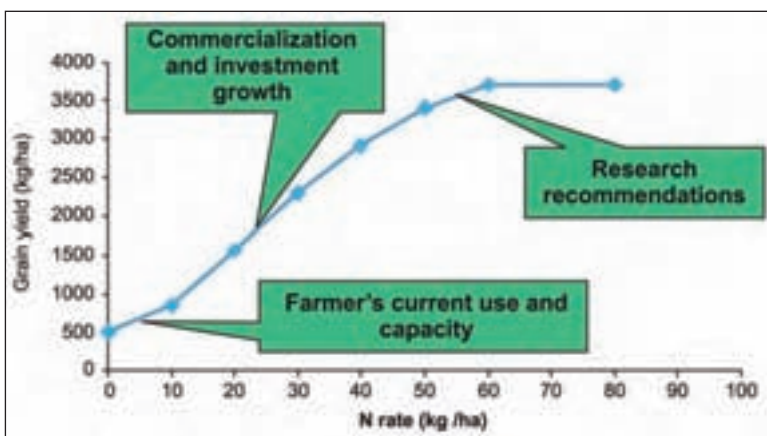


Figure 2. A typical fertilizer N response curve in relation to researcher recommendations, existing capacity of smallholder farmers to invest, and growth path for increased use

2.1. What is Microdosing?

Microdosing is the targeted application of N fertilizer at a quarter to a third of the currently recommended rates. It is part of a broader strategy to get farmers in dry areas to

appreciate and use mineral fertilizers. The *amount, timing of application* and *the placement* of the fertilizer in relation to the crop are very important!

√-Apply at the correct time

Fertilizer should be applied when the crop needs and can use the fertilizer. This should be at the 5–6 leaf stage. Application should always be done on wet and weed free soil.



The above crop is at 5–6 leaf stage, ready for microdosing.

√-Apply the right amount

The right quantity can be achieved by using the correct measure, a beer bottle cap per 2–3 plants, depending on the type of N fertilizer (Table 2).

Table 2. N content and application rates for different N fertilizers available in Zimbabwe

	Ammonium Nitrate (AN)	Lime Ammonium Nitrate (LAN)/Calcium Ammonium Nitrate (CAN)	Urea*
Nitrogen content	34%	28%	46%
Color	White	Grey	White
Application rate	1 beer bottle cap per 3 plants	1 beer bottle cap per 2 plants	1 beer bottle cap per 4 plants

**Urea fertilizer should be covered with soil after application*



The correct amount of fertilizer is one bottle cap per two to three plants.

√-Apply at the correct place in relation to the plant

The fertilizer should be spot placed at least 5 cm from the plant. Make sure that you do not place the fertilizer on any plant parts, leaves or stems as this could burn the crop.

To ensure maximum benefits, planting and weeding should be done at the right time. Effective pest and disease control are essential. More details on the various steps of the microdosing technology are presented in Annex 1.

2.2. Types of N fertilizer available in Zimbabwe

There are three sources of N available to Zimbabwean farmers and these are described in Table 2.

2.3. Evidence of success from the drier areas of Zimbabwe

ICRISAT and partners have been promoting microdosing by working with farmers to test ammonium nitrate (AN) and lime ammonium nitrate/calcium ammonium nitrate (LAN/CAN) on farmers' fields in the dry areas of Zimbabwe since 2003. There is substantial evidence indicating that 25–50% grain yield gains can be obtained with the application of as little as 10 kg of N per ha (approximately 30 kg AN per ha or 12 kg AN per acre). The use of these low rates of N has consistently given better yields than where farmers did not apply fertilizer, even in drought years (Table 3). Such small levels of chemical fertilizer significantly reduce the risks of application and are more affordable to poorer, small-scale farmers.



Note the placement of fertilizer in relation to crop. The picture on top shows the correct placement of fertilizer. The picture below shows the wrong way.



Table 3. Grain yield responses to low rates of AN in Hwange and Matobo Districts, Zimbabwe, in 2003–2004

District		Grain yield (kg/ha)	
		No fertilizer	With fertilizer
Hwange	Maize	488	611
	Millet	463	578
	Sorghum	477	596
Matobo	Maize	794	1343
	Millet	694	1041
	Sorghum	834	1192

Some of the farmers testing low rates of N in the dry areas of the country had this to say about microdosing:

Shona: Nzira iyi inoita kuti tishandise fetiraiza shoma asi zvochitipa mukoho wakanaka chose, James Jambwa, Masvingo District

Ndebele: Indlela le yenza ukuthi sisebenzise ifetilayiza elutshwane kodwa sithole isivuno esiphezule, James Jambwa, Masvingo District

This translates to *English: This method helps us use less fertilizer for higher yields, James Jambwa, Masvingo District*

Prisca Uta, one of the farmers who practiced microdosing, expresses the fact that the method helps the poor who cannot afford to buy fertilizer.

Shona: Chirongwa ichi chakanakira isu varombo vasinamari yokutenga fetiraiza.

Ndebele: Uhlelo lolu lulungele thina abayanga abangelemali yokuthenga ifetilayiza

Meggie Shumba had this to say about saving of inputs:

Shona: Microdosing yandishandira zvakanaka. Uye yandidzidzisa kuchengetedza fetiraiza.



A farmer in Zvishavane district, Zimbabwe, shows off his sorghum crop. The crop on the left has been topdressed with low rates of N fertilizer whereas that on the right has not received topdressing.

Ndebele: Imicrodosing ingifundise ukugcina ifetilayiza.

English: Microdosing has taught me how to save fertilizer.

It is important that farmers recognize that the yield gains achieved from these small doses depend on good crop management. Farmers should remember that good land preparation and timely and effective weeding are very important. A series of guides are presented in Annex 2 that describe the minimum requirements for good maize, sorghum, millet, cowpea and groundnut production. Furthermore, if heavy rains occur in the season, it may be necessary to increase the quantity of fertilizer applied as the rains may wash away the fertilizer.

2.4. How much fertilizer should a farmer buy?

The amount of fertilizer bought should match the land area to be planted. The amount needed is also dependent on the type of fertilizer. Table 4 gives an example of the amounts of AN, CAN/LAN, and urea required per hectare of maize.

Table 4. Amount of different nitrogen fertilizer formulations required per hectare

Area to be planted (hectare)	Rate of N applied (kg ha ⁻¹)	Approximate amount of fertilizer required (kg ha ⁻¹)		
		AN (34% N)	LAN/CAN (28% N)	Urea (46% N)
1	20	60	75	50

2.5. Where and how can farmers get fertilizer?

For farmers to purchase fertilizer, they need to know where it is available. Fertilizer should also be available within reasonable proximity for cost-effective use. Unfortunately, most rural retail shops do not always stock fertilizer. Farmers may have to organize themselves to purchase fertilizer. As fertilizer companies are usually reluctant to bring small quantities to individual farmers, farmers could form groups for buying it. This way the farmers can place their order with the fertilizer company directly or through a local retail shop. When there is a need to establish written agreements with the fertilizer company or retail shop, the agreements should clearly provide information on:

- the role of each partner in the procurement process;
- quantities of N fertilizer to be supplied;
- date and place of delivery, and
- costs to borne by the farmer.

The farmers will need to work with the local AGRITEX officers and other community leaders in developing the agreement documents.

2.6. How sustainable is microdosing?

One concern that may be raised is the sustainability of using such low levels of fertilizer, especially when only a single nutrient is being promoted. The reality is that the existing low levels of fertility investment by smallholder farmers are even more damaging to the sustainability of the soil resource, and, in turn, farmers' livelihoods. The yields obtained with the current fertilization rates are *low*, and farmers continue to *mine* nutrients from the soil without replacing them. This is not sustainable and will lead to continued decline in on-farm productivity. Hence, microdosing is the first step in lifting on-farm productivity and building the capacity of farmers so that they invest in manure and basal fertilizers.

Always use organic fertilizers such as manure and compost to build soil fertility!

Cattle, sheep and goat manures are sources of both N and P and a majority of smallholder farmers in the dry regions have access to these resources. Some have access to compost as well. In general, however, the quantity of manure/compost available has been found to be inadequate for the purposes of meeting the N requirements of crops on the amount of land planted each season. However, organic fertilizers are important for building good soil structure, leading to better water use and better yields. In fact, the use of manure will enhance the usefulness of the inorganic N fertilizer. Application rates of 3–6 tons of manure per ha, banded in the planting row will give a good crop response. Greater responses can be achieved

when the manure is applied in combination with N fertilizer at microdosing rates (Figure 3).

2.7. How can farmers maximize returns on their investment in fertility amendments?

There are several factors that determine the area planted each season. It could be that:

- the farmer may not have enough manure/compost to cover all the fields.
- the farmer may not have enough labor to adequately prepare land, plant, weed and control pests and diseases in a timely manner.

If faced with these constraints, farmers are advised to plant on smaller land areas. This way he/she will be able to:

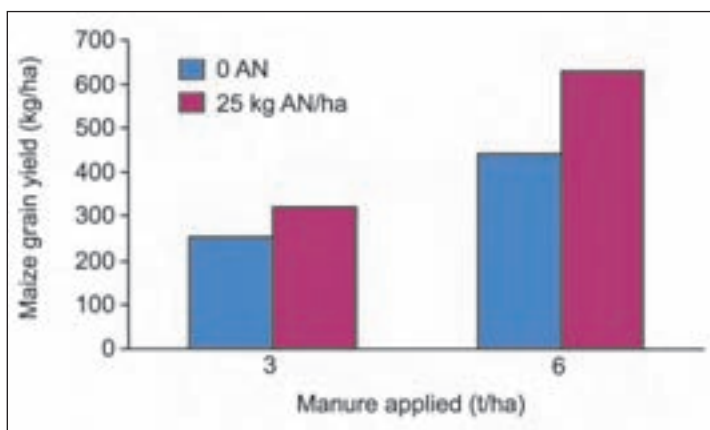


Figure 3. Maize grain response to different levels of kraal manure in combination with a low rate of N, Tsholotsho district, Zimbabwe, 2001/02.

- prepare the land on time,
- plant on time,
- meticulously control pests and diseases,
- weed effectively and on time, and
- correctly apply manure/compost and N fertilizer on time.

This will ensure that farmers get the most benefits from the manure and N fertilizer used!

3. Introducing and Promoting Microdosing to Smallholder Farmers

Introducing microdosing to farmers with no experience in using fertilizer may be challenging, especially if it is in areas where the local laws, enacted and enforced by the traditional leadership, prohibit the use of inorganic fertilizers. In this case, it is important to seek permission from the traditional leadership before establishing demonstrations on inorganic fertilizer use. It would be even better if you could go a step further and convince the traditional leaders to host the demonstrations on microdosing!!

3.1. Training farmers in microdosing

Microdosing is a simple technology that should be easy to train farmers on, as long as you have a clear understanding of what the technology is all about. You need to think through the following questions when preparing for the training session:

- Why do you think microdosing is relevant to the group of farmers you will be training?
- Who should attend the training?
- What materials are required for the training?
- In whose field will the training be conducted?

The training on microdosing should be done at the appropriate time of the season to apply N fertilizer. For the semi-arid areas in Zimbabwe this is in December and January.

All types of farmers should attend the training, including women and men, the young and the old. All will benefit from discussions and sharing of experiences.

3.2. Setting up demonstrations on microdosing

A demonstration on microdosing is like any other demonstration on any other agricultural technology that you may have established in past. There are certain factors you have to consider.

- The demonstration site should be well labeled and accessible to the farmers. This could mean that the field should be by the roadside so that farmers passing by are able to evaluate the effects of microdosing.
- The hosting farmer should be one whom most farmers are comfortable to visit. Do not choose the host for the farmers; you should facilitate the identification of the hosting farmers. Training will be done in the farmer's field. This farmer will lead in setting up the plots with the other farmers assisting. To foster a sense of responsibility, all interested farmers should be involved in managing the plots and contribute to the inputs used on the demonstration.
- The design of the demonstration should be simple enough to allow farmers to understand the message without difficulty. Do not have too many variables. In the case of microdosing, farmers should be able to compare the effects of microdosing against those of no fertilizer. So there should be two plots: one receiving small doses of fertilizer and the other with no fertilizer. All the other variables should be kept the same for the two plots. In other words, the land preparation, the seed used, the planting date, the weeding and the pest control should be the same for the two plots.

4. Conclusion

Low soil fertility is recognized as a major constraint to smallholder farmers producing adequate food to feed their families. The adoption of the microdosing practice by the smallholder farmers, in conjunction with the judicious use of farm organic fertilizers such as manure and compost, can increase the farmers' crop yields and incomes. It is recognized that microdosing is only the first step towards an integrated and sustainable soil fertility management strategy that makes use of a broad range of both inorganic and organic nutrient sources available to the farmers. The challenge for the extension staff is to facilitate the testing and evaluation of this suite of technologies, thus enabling farmers to make informed choices that depend on their own special circumstances.

5. References and Suggested Reading

Food and Agriculture Organization of the United Nations, 2006. Soil map of Zimbabwe.

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Annex 1. How To Use Small Quantities of Nitrogen Fertilizer

This pamphlet describes the best way to use nitrogen fertilizer in dry areas.

Why apply nitrogen fertilizer?

- It makes crops grow and mature faster
- It reduces the effects of late planting
- It increases grain yields

When to apply fertilizer?

- Apply nitrogen fertilizer 5–6 leaf stage.
- You can apply even slightly later, but it must be applied before flowering.

How to apply fertilizer?

- Take a beer bottle cap and fill it with fertilizer. This is enough for 2 to 3 plants
- **Do not** broadcast the fertilizer – carefully place it at least 5 cm from the base of the plant, as shown in the picture below
- You can use more fertilizer with more rains
- **Do not** apply fertilizer on dry soil



Should you use manure?

- Manure and fertilizer, both are important.
- If you have already applied manure or anthill soil, and later you apply fertilizer as well, yield will be even higher.



Left: maize crop that was top-dressed with low rates of N fertilizer

Right: stunted and pale maize without top dressing

Which crops should be fertilized?

- You can apply fertilizer to any cereal crop – maize, sorghum, or pearl millet.

What type of fertilizer to use?

- There are different types of nitrogen fertilizer, e.g. ammonium nitrate (AN), calcium ammonium nitrate (CAN), and lime ammonium nitrate (LAN).
- These three are very similar, and should be applied in the same way. Only the quantities will be slightly different, as shown in the table below.
- If you use urea, cover it with soil

Application rate for different fertilizers

	AN	LAN / CAN	Urea
Nitrogen content	34%	28%	46%
Color	White	Grey	White
Application rate	1/3 beer cap per plant	1/2 beer cap per plant	1/4 beer cap per plant

Cover with soil after applying urea

This pamphlet was developed by ICRISAT after testing the micro-dosing method extensively with farmers in several districts.

For more information, consult your local ARES officer.

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Annex 2. Minimum Requirements for Good Cowpea Establishment



Planting

- Plant as early as possible after the first rains. This will ensure best use of rainfall during the crop season. Early planting leads to good crop establishment.
- To check if there is enough moisture: take a hoe, dig a small hole, and look to see how wet the soil is. In clay soil the hole should be as deep as your hand. In sandy soil the hole should be two hands deep.
- If the soil is wet enough to plant, do not delay!



Apply manure or compound fertilizer at planting

- Do not broadcast – apply manure or fertilizer carefully, near the plant.
- Manure: apply whatever quantity is available (ideally 3-4 scotch carts per acre).
- Fertilizer: one-third of a beer cap per plant (50 kg per acre). You can use compound fertilizer or single super-phosphate.

Planting method

- Seeding rate: 15 kg seed per acre
- Spacing: half a pace between rows, one hand length between seeds
- Planting depth:
 - one index finger deep, in heavy soils
 - one and half index fingers deep, in sandy soils



Keep your fields free from weeds

Weeds are only a problem in the first 5 weeks – one weeding at 2-3 weeks is usually sufficient.

Early planting generally gives the best yields. But in dry areas, planting at different times will reduce impact of drought.

For more information, consult your local AGRITEX Officer

Minimum Requirements for Good Groundnut Establishment



Planting

- Plant as early as possible after the first rains. This will ensure best use of rainfall during the crop season. Early planting leads to good crop establishment.
- To check if there is enough moisture: take a hoe, dig a small hole, and look to see how wet the soil is. In clay soil the hole should be as deep as your hand. In sandy soil the hole should be two hands deep.
- If the soil is wet enough to plant, do not delay!



Apply manure or compound fertilizer at planting



- Do not broadcast – apply manure or fertilizer carefully, near the plant.
- Manure: apply whatever quantity is available (ideally 3-4 scotch carts per acre).
- Fertilizer: one-third of a beer cap per plant (50 kg per acre). You can use compound fertilizer or single super-phosphate.

Planting method

- Seeding rate: 20 kg seed per acre
- Spacing: half a pace between rows, one hand length between seeds
- Planting depth:
 - one index finger deep, in heavy soils
 - one and half index fingers deep, in sandy soils



Keep your field free from weeds

- 1st weeding at first flowering, just before top dressing. This is essential.
- 2nd weeding at pegging, followed by earthing up. This will further increase yield.

Top Dressing with Gypsum

Top dress at flowering stage, 100 kg per acre (2 x 50kg bags)

Early planting generally gives the best yields. But in dry areas, planting at different times will reduce impact of drought.

For more information, consult your local AGRITEX Officer

Minimum Requirements for Good Maize Establishment



Planting

- Plant as early as possible after the first rains. This will ensure best use of rainfall during the crop season. Early planting leads to good crop establishment.
- To check if there is enough moisture: take a hoe, dig a small hole, and look to see how wet the soil is. In clay soil the hole should be as deep as your hand. In sandy soil the hole should be two hands deep.
- If the soil is wet enough to plant, do not delay!



Apply manure or compound fertilizer at planting



- Do not broadcast – apply manure or fertilizer carefully, near the plant.
- Manure: half can per planting station (2-3 scotch carts per acre).
- Fertilizer: one-third of a beer cap per plant (25 kg per acre). You can use compound fertilizer or single super-phosphate.

Planting method

- Seeding rate: 10 kg seed per acre
- Spacing: one pace between rows, half a pace between seeds
- Planting depth:
 - one index finger deep, in heavy soils
 - one and half index fingers deep, in sandy soils



Keep your field free from weeds

- 1st weeding at 5 to 6 leaf stage, just before top dressing. This is essential.
- 2nd weeding at stem elongation (6 to 7 weeks). This will further increase yield.



Top Dressing with Ammonium Nitrate

- Apply one-third beer cap per plant (25 kg per acre), at 5 to 6 leaf stage.
- If rains are good and if you have enough fertilizer, apply once more at stem elongation, at the same rate.

Early planting generally gives the best yields. But in dry areas, planting at different times will reduce impact of drought.

For more information, consult your local AGRITEX Officer

Minimum Requirements for Good Pearl Millet Establishment



Planting

- Plant as early as possible after the first rains. This will ensure best use of rainfall during the crop season. Early planting leads to good crop establishment.
- To check if there is enough moisture: take a hoe, dig a small hole, and look to see how wet the soil is. In clay soil the hole should be as deep as your hand. In sandy soil the hole should be two hands deep.
- If the soil is wet enough to plant, do not delay!



Apply manure or compound fertilizer at planting

- Do not broadcast – apply manure or fertilizer carefully, near the plant.
- Manure: half can per planting station (2-3 scotch carts per acre).
- Fertilizer: one-third of a beer cap per plant (25 kg per acre). You can use compound fertilizer or single super-phosphate.

Planting method

- Seeding rate: 1 kg seed per acre
- Spacing: one pace between rows. Thin at first weeding
- Planting depth:
 - half an index finger deep, in heavy soils
 - one and half index fingers deep, in sandy soils



Keep your field free from weeds

- 1st weeding at 5 to 6 leaf stage, just before top dressing. This is essential.
- 2nd weeding at stem elongation (6 to 7 weeks). This will further increase yield.



Top Dressing with Ammonium Nitrate

- Apply one-third beer cap per plant (25 kg per acre), at 5 to 6 leaf stage.
- If rains are good and if you have enough fertilizer, apply once more at stem elongation, at the same rate.

Early planting generally gives the best yields. But in dry areas, planting at different times will reduce impact of drought.

For more information, consult your local AGRITEX Officer

Minimum Requirements for Good Sorghum Establishment



Planting

- Plant as early as possible after the first rains. This will ensure best use of rainfall during the crop season. Early planting leads to good crop establishment.
- To check if there is enough moisture: take a hoe, dig a small hole, and look to see how wet the soil is. In clay soil the hole should be as deep as your hand. In sandy soil the hole should be two hands deep.
- If the soil is wet enough to plant, do not delay!



Apply manure or compound fertilizer at planting



- Do not broadcast – apply manure or fertilizer carefully, near the plant.
- Manure: half can per planting station (2-3 scotch carts per acre).
- Fertilizer: one-third of a beer cap per plant (25 kg per acre). You can use compound fertilizer or single super-phosphate.

Planting method

- Seeding rate: 2 kg seed per acre
- Spacing: one pace between rows. Thin at first weeding
- Planting depth:
 - half an index finger deep, in heavy soils
 - one and half index fingers deep, in sandy soils



Keep your field free from weeds

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About ICRISAT



ICRISAT
Science with a human face

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Centers of the Consultative Group on International Agricultural Research (CGIAR).

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