REPUBLIC OF NIGER
MINISTRY OF AGRICULTURE DEPARTMENT
OF STUDIES AND PROGRAMMING

Japan International Research Center for
Agricultural Sciences

Effective use of technology microdose fertilizer

December 2012

Appendix: Technical Manual 5

"Guide for the Management and Natural Resource Conservation"

Manual for efficient use of fertilizer microdose technique

~ Version for Niger ~

PREFACE

Le Ministère de l'Agriculture avait signé en 2008 un mémorandum d'entente avec le Centre Japonais pour les Recherches Internationales en Sciences Agricoles (JIRCAS) pour la réalisation de **l'Etude sur le développement des méthodes de gestion et de conservation des ressources naturelles pour la production agricole**. Cette étude qui avait démarré en 2008 pour une durée de cinq (5) ans doit s'achever en fin 2012, avec l'élaboration d'un Guide sur les méthodes de planification pour la gestion et la conservation des ressources naturelles .

En vue d'une meilleure application pratique , le Guide est accompagné de cinq (5) manuels techniques dont entre autres le **manuel sur la Micro dose d'engrais** qui permet une utilisation efficace d'engrais. Cette technique de placement mécanique de micro doses d'engrais avait fait l'objet de recherches conjointes dans le passé entre l'Institut National de Recherche Agronomique du Niger (INRAN) ; l'Institut international de recherche sur les cultures des zones tropicales semi arides (ICRISAT) et le projet Intrants. Les bons résultats de ces recherches qui ont été obtenus ont amené JIRCAS à tester cette technologie.

La technique de la micro dose d'engrais comporte deux variantes. La première qui consiste à l'apport mécanique d'engrais séparé de la semence est de plus en plus abandonnée. La deuxième qui consiste à placer l'engrais dans le même poquet que la semence lors des semis est actuellement plus vulgarisée . Mais chaque méthode a ses avantages et ses inconvénients. C'est pourquoi JIRCAS a retenu de décrire les deux méthodes dans le présent manuel technique .

Le Secrétaire Général Adjoint

RÉPUBLIQUE DU NIGER
Secrétaire Général Adjoint
MINISTÈRE DE L'AGRICULTURE

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1. How is fertilizer microdose technical manual placement born?

Sandy soils of the Sahel region of Niger are often deficient in nitrogen and phosphorus, both of which have considerable influence on the growth of agricultural products (Bationo and Mokwunye 1991). In general, farmers use household garbage and animal waste on crops or fields to improve soil fertility. However, one problem remains because these fertilizers do not act quickly and nutrients can not be supplied to the plants when they really need (Giller et al., 1997, Bationo et al.

1998).

The use of chemical fertilizers could be considered in order to solve this problem, but these have a very high fertilizer prices for farmers in the Sahel region of Niger, and it is therefore difficult for them to use large amounts of 'chemical fertilizers. Furthermore, many farmers reserve Fertilizers they are able to use to cash crops in the rice fields, which is why these fertilizers are not used for rainfed crops. Because of this situation, the National Agricultural Research Institute of Niger (INRAN) and the International Research Institute for the Semi-Arid Tropics, ICRISAT Sahelian Center (known in English *International Crops Research Institute for the Semi-Arid Tropics)* conducting joint research to date, in order to improve efficiency and the use of fertilizers for agricultural products and reduce the costs of agricultural equipment for underprivileged farmers. (Bationo et al., 1998, and Buerkert Hiernaux 1998). As a result of this research, it was possible to confirm that the introduction of small amounts of fertilizers near plant roots it possible to obtain higher yields than spreading to cover these fertilizers in the fields which was hitherto practiced by the vast majority of farmers. This placement of small doses of fertilizer was the beginning of the technique manual placement microdose fertilizer.

In fact, the technique of manual placement microdose fertilizer which is widespread in Niger consisted initially applied mainly small quantities of chemical fertilizers near plant roots, by hand or by using the lids bottles that are easily accessible to farmers. This technical manual placement microdose fertilizer is not only widely distributed recently, but initiatives have also been taken for the establishment of a parallel Warrantage system integrating POS

material and agricultural equipment inside the village where farmers can buy fertilizer at low prices, and a microfinance function (Tabo et al., 2006). This initiative was implemented in three African countries, Niger, Mali and Burkina Faso, and provided convincing results since farmers benefited from an increase in their sorghum harvests of millet (44 to about 120%) as well as their income (from 52 to 134%), among others (Tabo et al, 2006).

2. What is the technique of manual placement of fertilizer microdose?

2.1 Description of the technique manual placement of fertilizer microdose

The manual placement microdose fertilizer is a technique that involves placing small amounts of fertilizer around plants. In Niger, this technique is to manually put a pinch of fertilizer or a bottle cap in bunches at planting, or plant roots during the growing period. Niger's farmers tend to use large amounts of fertilizer for cash crops such as rice and cotton and therefore very little they use them for their own consumption crops. According verbal surveys of farmers, they currently use about 100 kg of fertilizer per hectare for their fields.

In the case of millet, farmers carry the seeding intervals of 1 mx 1 m, and 10,000 plants are grown per hectare. In this case, the amount of fertilizer used in microdose is about 50000G per hectare since dose is about 5 g. This amount of fertilizer can be easily supported even by farmers and can be considered as a possible dissemination of this technique in Niger.

2.2 How to Use microdose

The effects of microdosing appear 15th about day after sowing, when the rains were sufficient (more than 15 to 20 mm) and when soils contain adequate water content. When the roots of the seedling start to grow a small amount of fertilizer (NPK compound 15: 15: 15) is placed in a somewhat remote location (5 to 10 cm) roots. After the first application of fertilizer, a small amount of urea is applied as additional fertilizer about a month later. At that time, it is best to bring this dose after making weeding and thinning so that fertilizers only benefit the crops. In the case of pulse crops, such as cowpea and

peanuts, only intake of NPK (15: 15: 15) or DAP should. To avoid double work, farmers often put seeds and fertilizer together in the planting hole at planting. However, when the rains fail after sowing, the seeds end up losing their faculties germination under the action of chemical fertilizers that have a so contrary to their original purpose and prevent the growth of the plant. To ensure that these valuable fertilizer are not wasted, we recommend to carefully follow the precautions listed below when using the technique of microdose fertilizer.

Precautions for using the technique of manual placement microdose fertilizer after planting

1. Check the soil contains enough water when Contributed microdose fertilizer!

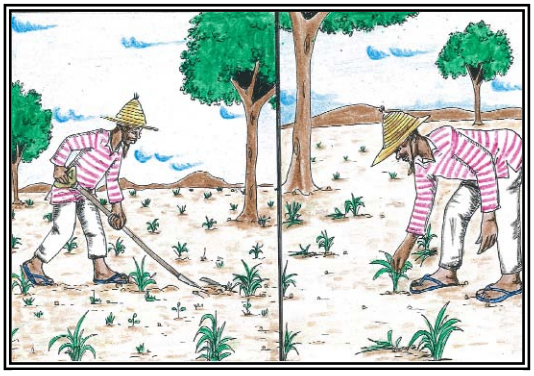
2. Place the first microdose approximately 15 days after setting Place crop!

3. For the first intake, use as fertilizer compound NPK (15/15/15)!

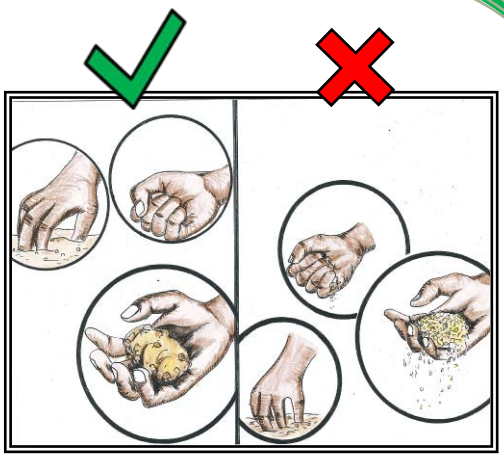
4. On cereals (millet, sorghum, corn), placing a small amount of urea about a month after the first application of fertilizer, manure as maintenance!

5. Place the additional fertilizer after finishing weeding if the producer has the means to do 2e bring.

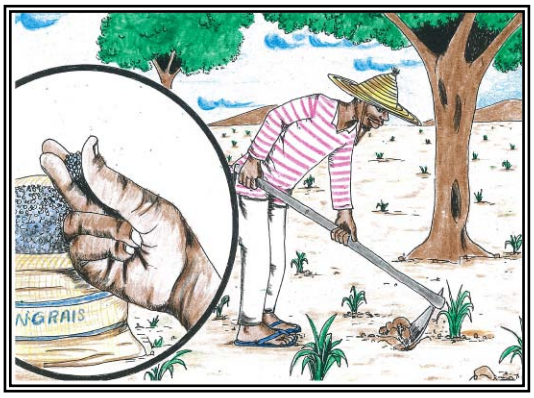
The concrete procedure of microdosing is shown in the illustrations below.



(1) Complete weeding and thinning.



(2) Check soil moisture by tightening the earth in the palm of the hand. If it hardens, it means that the water content is sufficient!



(3) Dig near the root of the plant and introducing a pinch of chemical fertilizers.

(4) Although cover with soil.

(5) You can expect a good harvest!

3. Tips for better dissemination technique microdose manual placement of fertilizer!

3.1 Steps for spreading the fertilizer microdose technique

The following steps are recommended to first establish the technical manual placement of fertilizers and microdose then broadcast it.

Period	Step	Content of Work	duration
First year, dry season	Step 1	Organize training courses on the agricultural techniques and present technical manual placement microdose fertilizer. Note: Refer to the attached document for details on the content of training.	2 hours
First year at the beginning of the rainy season	2nd step	Provide several demonstration fields in the village and actually proceed with the implementation of technology.	3 to 4 days
First year the end of the rainy season	step 3	Conduct a performance appraisal at the time of harvest in the demonstration fields.	1 week
Second year, season dried	step 3 	Proceed back to training before the start of the rainy season. This training aims to explain to farmers the results of the performance study in demonstration fields. Provide farmers with problems identified from the results of the study of the performance of the previous year and discuss measures to be taken because it is important that farmers understand the precautions.	2 to 3 hours
Second year, rainy season	step 4	For the demonstration fields are left untouched, it is necessary to gain the cooperation of farmers by confirming the location of the fields and the terms of their management and maintenance.	3 to 4 days
Second year, rainy season	step 5	Select a window of opportunity for farmers to be available during the period of crop growth and make the observation of demonstration fields. Confirm with them the effectiveness of the technique manual placement microdose fertilizer.	2 to 3 hours
Second year, rainy season	step 6	Conduct a performance appraisal at the time of harvest in the demonstration fields.	1 week
Third year, season dried	step 7	Gather farmers proceed again to the explanation of the study results and performance to exchange opinions. In case of problems, renew discussions to find ways to solve them.	2 hours

From the third year, dry season	Step 8 (Optional) 	Proposing the establishment of a point of sale materials and agricultural equipment where you can buy fertilizers at low prices, so that farmers continue to apply the technique microdose fertilizer. For the procedure of setting up the point of sale, we recommend to refer to the FAO (2006).	6 months to 1 year

3.2 Dissemination tools: Number 1 [The posters]

The posters are very effective as a tool for dissemination of technical microdose fertilizer (Photo 1). These posters will in particular include a minimum of written text and focus on illustrations and pictures because the literacy rate is lower in rural areas. They will be easily understood by all, regardless of age or gender distinction.

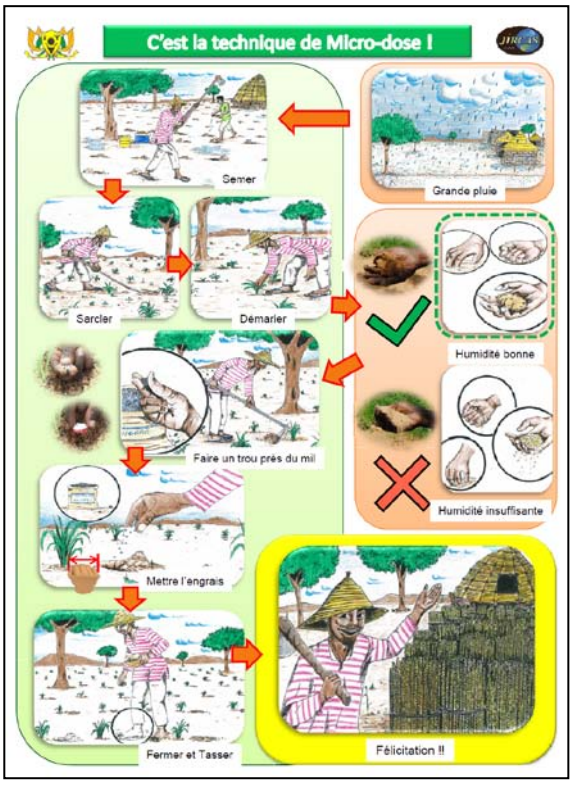
When these signs are used for training, facilitators should not fully explain but to ask about the photos as "In your opinion, what does he do? "Or" What is this work? "To reflect the farmers participating in the training. If training is lecture-type farmers are passive, and they only seem to have lost some time during a boring lesson.

Then when you have enough time, ask a participant who understands take the place of the facilitator to explain to a member who has not understood. The best way to memorize oneself is to teach someone and to transmit what we have learned.

The posters that were used during the training must remain in the village after training. If they are displayed in a place where they are easily visible, as in the village meeting room, they can be used to communicate subsequently technique microdose fertilizer to villagers who were unable to participate in training .

Posters on the technique of fertilizer placed in microdose

a village meeting room



3.3 Dissemination tools: Number 2 [Implementation of demonstration fields]

It is particularly important to provide farmers with opportunities to choose effective agricultural techniques, showing them concretely the influence of different techniques that can be used in the Sahel region on the cultivation of millet, which is the main cereal grown in this region.

For the dissemination of technical microdose fertilizer, demonstration fields were set up to concretely demonstrate to farmers the effects. Five demonstration fields were set up in each village. These fields have been divided into four different plots of treatment, (1) a control plot without fertilizer (T), (2) a plot only with microdose (R), (3) a plot with only the organic material available to farmers (MO) and (4) a plot with joint use of microdose and organic matter (MO + MD).

In fact, men and women have found differences in the amounts of crops in the first year and some farmers want to use this method the following year. Women in particular, who had been asked to pound millet obtained in the demonstration fields, remembered the name of each plot and remembered that the plot with joint use of microdose and organic matter had produced significant amounts. The interest of women in the technical manual placement of fertilizer microdose seems to have tripped on this occasion.

It is important not to be confined to training and oral teaching but to demonstrate the real practice to generate interest among farmers.

3.4 Dissemination tools: Issue 3 [Observation demonstration fields]

Farmers can obtain information and look at some pictures at the technique. It is difficult to contextualize the technique which is not enough to understand the process. So they are not motivated enough in using microdose technique. Observation of demonstration fields is very effective because it allows participants to show the technical and farmers.

In reality, they will have an idea of using the microdose technique through the experience of visual perception of the effect of the art in the demonstration fields of their village.

Observation of demonstration fields was performed two years after their creation in the village. The fields in the demonstration produced a superior effect to the control fields in levels of the other three plots. During the visit of the field demonstration, farmers, the agriculture department and the facilitator had to visit and observe the situation of two or three demonstration fields. Participants were interested in the demonstration plots containing both microdose its combination with organic matter. They asked the facilitator and the agriculture department how they can purchase fertilizer and organic matter in order to apply this technique in their own fields.

Therefore, the observation of demonstration fields is effective to provide opportunities to exchange agricultural information between farmers and agricultural service, no card only on manual microdose technique.

4. The dissemination of women is also possible!

4.1 The technique of microdose manual placement of fertilizer corresponds perfectly to the interests of rural women

Culture in the field is not a job for men. Among women, some have a field that is often not very big but that is important to them because it is a source of income. Women do not grow millet, which is the main cereal, but practice cultures box (okra, sesame and peanuts) in small areas and, if they do not have a very large production. The sale of these products is an income generating activity for them. Women, who have lower incomes than men, wish to experience and use the techniques enabling them to increase yields by reducing costs, even at the minimum. The technique microdose fertilizer is a technique that perfectly suits the needs of women.

4.2 Women's Training Method

Women do not easily give their opinion before men. We can often see this situation in rural areas in Niger. If one ear only ready for the opinion of men, dissemination of technology among women will be difficult. So it is best here to ask the men prior to permission and organize training or meetings separately for men and for women. By adopting this approach, women will learn and quickly master the technique and it will also be possible to know the problems that women face daily. By repeating these operations, the start of the next stage begins to appear by using for example the technique of microdose associated with other agricultural techniques if the need arises.

The content of the training can be fully understood even by women is the same as training for men, since women also get income through cash crop in their field. To determine the timeframe that best training, it would be ideal to learn from women but the best time should be selected whenever possible after 15 hours, avoiding the busiest periods of the morning and noon to prepare meals and care for children. The location of the training will preferably be in their village women.

4.3 Points to be considered for the transfer of technologies to village women

Some village women show particular aptitude for assimilating new knowledge and are able to speak perfectly French. These kinds of women can become key persons for dissemination techniques. If it is the daughter of the village chief or a woman after her family or if the woman is president of a group of women there is no major problem for this woman be selected as a key person. However, if this is not the case, the woman who has been positioned as a key person almost immediately ruled out the activities. It is therefore necessary to make sure that women who wish to participate in activities are not shelved due to human and social relationships within the villages.

Therefore, the best way to prevent this problem from occurring is to treat the extent possible all women on an equal footing, to listen to as many opinions villagers and choose woman accepted by all to load disseminate techniques and implement the necessary activities.

Things to consider when transferring technologies to women

· When women can not express their opinion before men, organize training and separate meetings for men and women.

· Selecting the key person for the dissemination of technology among Women should be made after taking advice from the villagers and respecting their opinion.

5. What to do to more effectively use fertilizers microdose technique?

5.1 Introduction of a point of sale materials and agricultural equipment or system Warrantage

Even if farmers are showing interest in the technique of microdose fertilizer, they can not use it if they do not possess chemical fertilizers. To solve this problem, it is important to consider the establishment of a point of sale of agricultural machinery and equipment where farmers can buy these fertilizers at low prices or the establishment of a microfinance system providing funding their to acquire agricultural equipment even if it requires some time.

Regarding the establishment of a point of sale materials and agricultural equipment, we recommend taking to the reference manual developed by FAO in 2006 (FAO 2006 a) which is extremely easy to understand. We also recommend, as a microfinance system providing funds for the purchase of agricultural machinery and equipment, the establishment of Warrantage system (FAO 2006 b).

The Warrantage is a system with integrated functions of microfinance. Farmers in the Sahel do not have easy access to the same credit system if they want to borrow money. Therefore, they sell their products immediately after harvest even if market prices are low to get money. As a result, they are only a small profit, and the funds for the purchase of materials and equipment (seeds and fertilizers) for the production of crops for the following year are often insufficient.

The Warrantage system consists of a storage system to sell the harvested products when market prices are rising and a financing system taking as collateral the products harvested and placed in storage, which thus offers a way of exit the vicious cycle presented above.

The Sahelian Center ICRISAT in Niger has implemented the 2004-2002 FAO initiative for simultaneous introduction of Warrantage system and technology microdose fertilizer in rural Niger, Mali and Burkina Faso (Tabo et al., 2006). As a result, the harvest of the main cereals are sorghum and millet rose 44% to 120 about through the use of technology microdose fertilizer. In addition, the income of farmers who have made use of not only the technical microdose fertilizer but also Warrantage system increased by 52 134% about (Tabo et al., 2006). For details,

we recommend that the Final Report of ICRISAT Sahelian Center (Tabo et al. 2006) as a reference document.

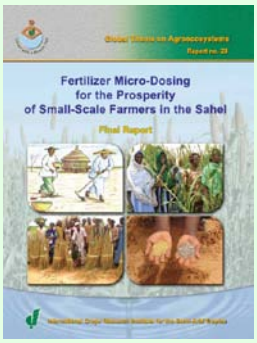
Reference Manual

- **FAO (2006 at) installation guide and management of agricultural input shops cooperative character.**

- **FAO (2006 b) Film FAO "Warrantage in Niger"**
  http://www.capitalisation-bp.net
  (After accée, acccueil → Resources → Wrrantage → Film FAO "Warrantage in Niger")

Reference documents

- **Tabo R Bationo A Maimouna Diallo K Hassane O and S Koala (2006) Fertilizer mirco-dosing for the prosperity of small-scale farmers in the Sahel. Final report June 2002-December 2004. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).**



5.2 Lessons from the results of the experiment in the demonstration fields

As part of the dissemination of technical microdose fertilizer that was implemented in the Sahel in Niger, demonstration fields have been built so that farmers can actually see the effects of this technology (Figure
1). The village of Kare (KR: North Latitude 13 ° 03 'west longitude 2 ° 20') and the village of Lontia Kaina (LK: North Latitude 13 ° 06 'west longitude 2 ° 19') were chosen as targets and 4 demonstration fields were installed in each of these villages. These fields have been divided into four different plots of treatment, (1) a control plot without fertilizer (T), (2) a plot only with microdose (R), (3) a plot with only the organic material available to farmers (MO, photo) and (4) a plot with combined use of microdose and organic matter (MO + MD). The organic materials available to farmers indicated here are a mixture of household refuse, manure and crop residues.

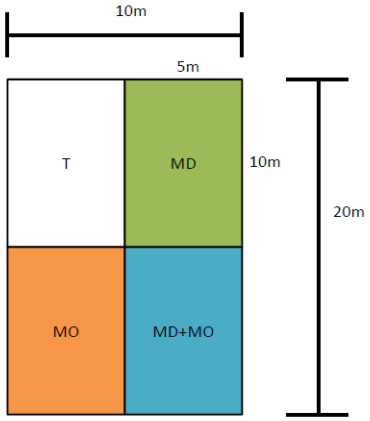


Figure 1 Map of a demonstration field

Organic materials available to farmers (left) and transport these Contents (right)

These two villages in the village of KR, which benefited from higher rainfall than the village of LK, crops of millet increased by about 100 kg / ha in plot MD, about 200 kg / ha in plot MO and about 300 kg / ha in the plot MD + MO, in comparison with those of the control plot without fertilizer T (Figure 2, left). On the other hand, in the village LK where rainfall was low, the effects of the technique microdose fertilizer did not appear (Figure 2, right).

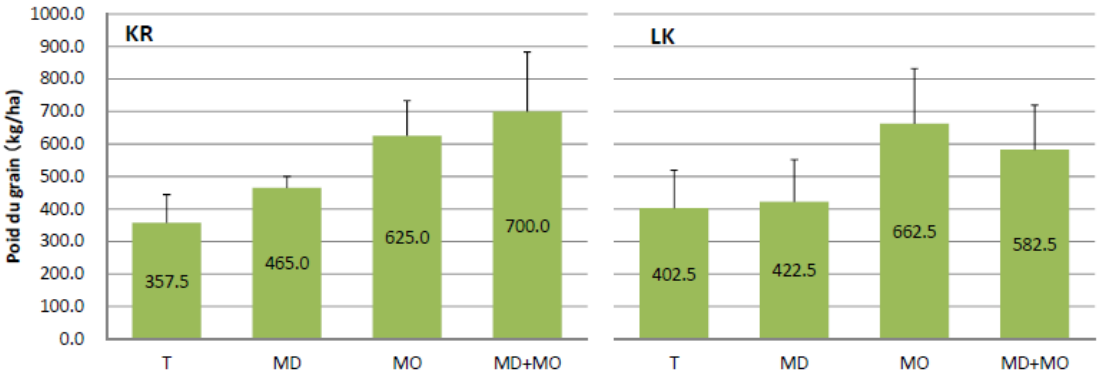


Figure 2 grain yield in KR villages and LK in 2011

These effects are not produced not only because of low rainfall but becaufe the millet grain and chemical fertilizers were placed in the same planting hole in the village LK. Since, in addition, the rains have unfortunately not been sufficient, cereal seeds were burned by chemical fertilizers. As a result, these fertilizers have an effect contrary to their original purpose and prevented

plant growth.

In the plot MO + ®, chemical fertilizers and organic materials were provided throughout the growing season of crops and increase crop has been noted. In addition, improved physical properties of soil due to the contribution of organic substances could be detected and decreased soil leaching through chemical fertilizers, this has also contributed to the increase in harvests.

The results of the study of demonstration farms set up this time, the points to be considered for a more efficient use of the technique microdose fertilizer are indicated below.

Points to consider for a more efficient use of fertilizer microdose technique

· Do not put all the seeds and fertilizers in the same pocket.

Dig two separate holes and place them apart!

· To increase the effects of micro-dosing and for harvest yet more abundant, it is effective to use organic materials at the same time as household garbage, dung and crop residues!

6. Targeted region by diffusion

It is desirable that this technique is applied to the south of the Sahelian zone of the Republic of Niger (annual rainfall of over 350 mm).

7. References

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Diallo Maimouna K. Hassan O., Koala S. (2006) Fertilizer
micro-dosing for the prosperity of small-scale farmers in the Sahel. Global Theme is Agroecosystems Final report June 2002-December 2004, International Crops Research Institute for the Semi-Arid Tropics.

Documents attached

Document in Annex 1 Example of technique training

microdose fertilizer

1. Training Program

The training program for the improvement of soil fertility

- Date: 30 / 05-31 / 05 (Kare), 02 / 06-03 / 06 (Lontia Kaina)
- Heur: in matiné men, women afternoon
- Place in Karé and Lontia kaina
- Participants: Population Village, Agriculture Department, Members JIRCAS

2. Training Content

- 1st day

theme; On microdose and supply of organic matter

① Greeting opening

② Explanation microdose and use of organic materials

③ Presentation of the test results in 2011

④ Explanation on problems microdose

⑤ Discussion

- 2me day

theme; On the cowpea rotation and millet

① Greeting

② Explanation of millet and cowpea rotation

③ Explanation of the test problems

④ Discussion

⑤ Fenced

3. Training Tools

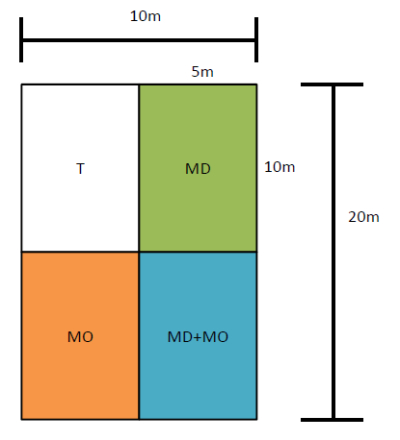
Because this training is for farmers, it is preferable that the explanations are given using maximum graphics and illustrations.

Posters used during the training scenes and training

(Photos below)

Document in Annex 2 treatment experimental plots in demonstration fields and results of the performance study

experimental treatment of plots in the demonstration fields



① Witness

② MD: Microdose only

③ MO: Organic material alone

④ MD + MO Microdose and organic matter

Results of the performance study

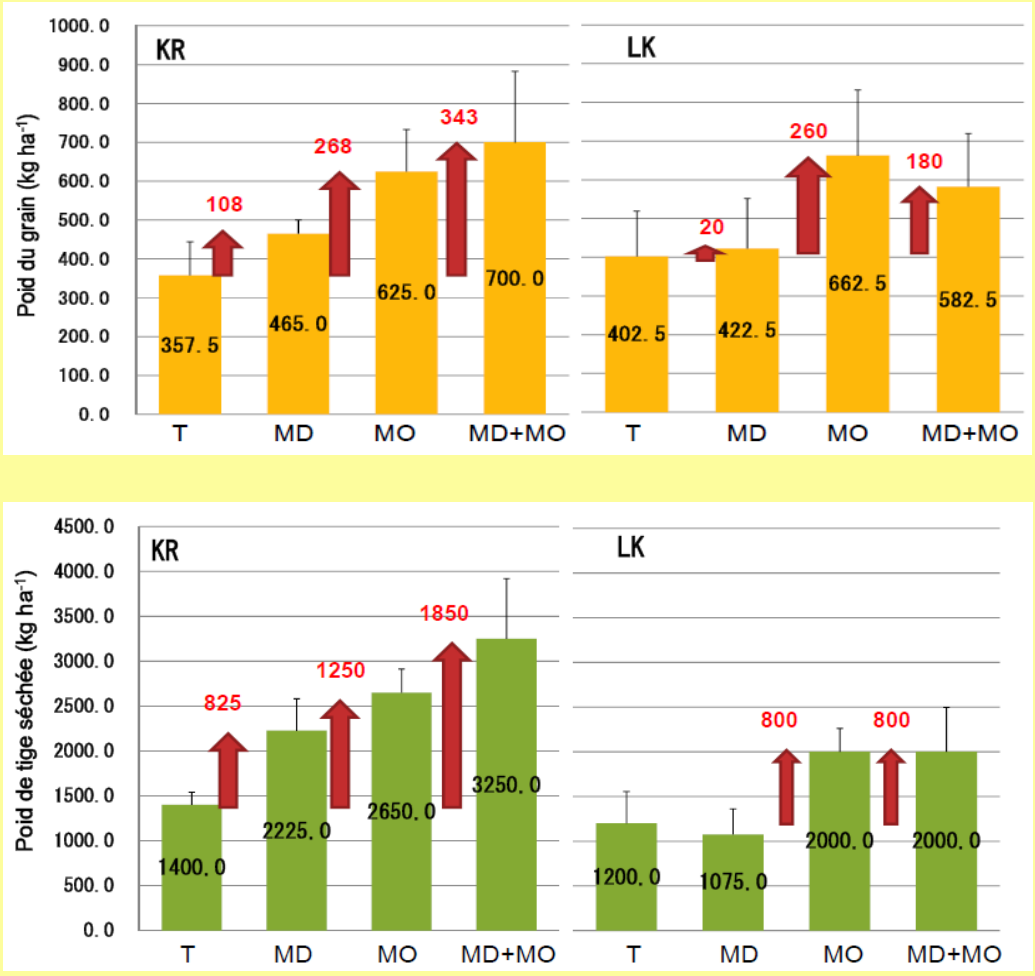


Figure 1. Grain yield (top) and the weight of dry rod (bottom) in two villages KR: Kare Village; LK: Village Lontia Kaina. Vertical lines: standard error of the mean.

The red numbers correspond to the average increase over the plot of the witness.

Author's manual

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