HORTIN II Co Innovation Programme

Towards cost effective, high quality value chains

Improvement of shallot supply chains; Research Report 2010; Dissemination of shallot production technology of True Seed Shallot (TSS) through conducting farmers' fielddays on participatory demplots

HORTIN-II Research Report nr. 19

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The purpose of the HORTIN-II programme is to contribute to the development of cost effective high quality value chains for vegetables and fruits. Among others this can be achieved when technology development takes place in close collaboration between public institutions, farmers and private companies.

On the Indonesian side the programme is carried out by the Indonesian Centre for Horticultural Research and Development **(ICHORD),** Jakarta, with the Indonesian Vegetable Research Institute **(IVEGRI)**, Lembang, and the Indonesian Centre for Agricultural Postharvest Research and Development **(ICAPRD)** in Bogor.

In the Netherlands the Agricultural Economics Research Institute **(AEI)**, Den Haag, the Agrotechnology and Food Sciences Group **(ASFG)**, Wageningen, Applied Plant Research **(APR)**, Lelystad, and WUR-Greenhouse Horticulture **(WUR-GH)**, Bleiswijk, all partners in Wageningen University and Research centre, are involved in the programme.

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Executive summary

In 2010 the activities were focused on dissemination of the results obtained in 2007 – 2009. Demo fields were conducted on six locations: two in Brebes, three in Nganjuk and one in Yogjakarta. On three of these locations a field day was organized. On these field days results were presented and shown on posters. A leaflet giving a guide line for TSS production was handed out to each visitor. A local TV-station has presented the activities of the field day in Nganjuk on television.

Based on the experiences in 2010 the following conclusions were drawn:

- At farmers' level, using TSS as planting material was cheaper than that of using traditional tuber seed.
- Cost of seedling for planting TSS Sanren in 75 plants/ m^2 was cheaper than that of costs of traditional tuber seed if the price of the tuber seed was IDR 10000/kg or more. But for planting in 150 plants/ m^2, it was cheaper only when the price of local tuber seed was more than IDR 15000/kg.
- Under rainy condition, the average yield of TSS Sanren was higher than that of TSS Tuktuk, but it could be higher or lower than that of local tuber seed. The yield of TSS Sanren would be higher if the local tuber seed was more succeptible to the damage of the rain, and could be lower if the local tuber seed was more resistant to the damage of the rain.
- For TSS Tuktuk, at farmers level and under rainy condition, high plant density (150 plants/m^2) and high dosage of N fertilizer (240 kg N/ha) gave a higher yield than that of low density (75 plants/ m^2) and low dosage of N fertilizer (120 kg N/ha).
- For TSS Sanren, the effect of plant density on yield was not consistent. But the effect of N fertilizer application on yield was clear. The yield of TSS Sanren with 240 kg N/ha was higher than that of with 120 kg N/ha.
- Farmers preferred TSS Sanren to TSS Tuktuk because they valued that the characteristics of TSS Sanren in terms of crops growth, resistance to pest and diseases, tuber size, tuber colour and market acceptance were better than that of TSS Tuk Tuk.
- In the nursery, farmers preferred sowing the seed in row, with sowing depth of 1 cm, covering the row with soil or mixture of soil and stable manure and putting a shelter over the nursery. Farmers perceived that the technique was practical and gave optimum seed efficiency.
- In the field production, farmers in Brebes preferred to plant TSS Sanren in 60 plants/ m^2 with 120 kg N/ha, while farmers in Nganjuk preferred to plant TSS Sanren in 150 plants/ m^2 with 240 kg N/ha.
- Through observation and evaluation on farmers' participatory demplots, about 52% of farmers participant in the field days admitted that they were interested to try out TSS and some of them continue with a small trial on TSS Sanren.
- Methods of farmers-participatory demplots was an effective way to disseminate TSS technology to farmers in terms of:
    - Providing farmers with practical aspects of TSS technology
    - Arising farmers' awareness and interest of TSS technology
    - Giving farmers opportunity to evaluate the benefits and disadvantages of TSS technology
    - Stimulating farmers to try out TSS technogy in small scale

The following recommendations are given:

- TSS Sanren is recommended to be introduced to farmers as an alternative of traditional tuber seed.
- TSS Sanren is recommended for planting in dry season only.

- In the nursery, it is recommended to sow the seed in row, in 1 cm depth, cover the row with soil and using shelter.
- In the field production the effect of plant density and dosage of N fertilizer on the yield of TSS Sanren needed to be confirmed in further experiments.
- To disseminate TSS Sanren to farmers it is recommended do it by using farmers'participatory demplots.

1 Introduction

In Indonesia, in the period of 2002 - 2008 import of consumption shallot increased about 390% from 32928,783 ton (or 9,1 milion US$) to 127830,473 ton (or 53,7 juta US$) (BPS, 2003 dan 2009). To reduce import and to safe devisa, increase of shallot production and productivity need to be done.

But, to increase shallot production and productivity farmers face contraints of low quality and expensive tuber seed. To increase shallot production and productivity, from year to year more and more farmers rely on and plant imported tuberseed which is expensive and most probably infected by tuber borne diseases.

An alternative solution to increase shallot production and productivity is the introduction of TSS in the traditional shallot production system. Compared with traditional bulbseed, there are some advantages of TSS (Permadi, 1991; Putrasamedja, 1995; Sumarni *et al.*2005; vanden Brink and Basuki, 2007, 2008 and 2009):

- Seed rate per hectar is about 7.5 kg compared with 1,5 ton of bulbseed.
- Lower transport costs of planting material
- Relatively free from virus and other seedborne diseases.
- Lower cost planting material.
- Higher yield.

Despite the advantages of TSS compared to traditional bulb seed, the adoption of TSS at farmers' level was low. This happend because the optimal techniques of TSS nursery and field production has not been understood by the majority of farmers.

In the period of 2007 to 2009 research on nursery and production field of TSS was conducted under Hortin II Programme. The results showed that to obtain optimal results in nursery and production field of TSS a set of techniques procedures need to be done (vanden Brink and Basuki, 2007, 2008 and 2009).

The aim of the project activities in 2010 was to disseminate the research results obtained in 2007 - 2009 to target farmers in lowland shallot production centres. The research results were presented in participatory demplots which contained information about: 1) effect of technique of nursery on seed efficiency, and 2) effect of dosage of fertilizer & plant spacing on yield of different varieties of TSS.

It was expected that the target farmers will learn the techniques of nursery and field production of TSS in the demplots, which in turn will stimulate them to adopt TSS. Besides that, in this research researchers would get feed back from farmers on how to improve their techniques of growing TSS to be more appropriate to farmers' condition. Further, the findings from this research could be used to design strategies for TSS dissemination in other area.

Picture 1. Demo field in Brebes in 2010

2 Methodology

2.1 Preparation of demonstrating plots establishment

a. Selection of locations

Locations for this dissemination activities were spreaded in a long distance area of three main lowland shallot production centres. The locations and distance from the researchers' base, Lembang - West Java, were Brebes (±200 km), Yogyakarta (± 500 km) and Nganjuk (± 650 km). The locations were selected purposively with expectation that the activities will get a big impact in the shallot production centre area.

b. Selection of key farmers

Key farmers were selected by EWSI field staff in the location. All key farmers have experiences and were successful in growing TSS crops in the previous years. The key farmers' role was very important. They conducted and maintained the demplot properly and intensively to ensure the demplot performed well at the moment when fielddays were conducted. However, the selected key farmers did not automatically willing to join the dissemination activities. From previous experiences they had evaluated the disadvantages of growing TSS, particularly Tuk Tuk variety and did not too enthusiastic join in the activities. But, by explaining to them that the inputs of demplot will be financed by researchers, they became willing to join.

c. Approach to key farmers

To attract key farmers willing to join in demo plots, researchers explained about the contribution of actors involved in the **a**ctivities. The contribution of actors is presented in Table 1.

d. Presentation designs of demonstrating plot

Designs of demplots were presented to key farmers after they agreed with the contribution of each actors and committed to join in the dissemin**a**tion activities. Design of the demplots and its operating procedures are presented in appendix 1 and 2. However, farmers did not fully agree with the design of demplot and operating procedures recommended by researchers because of several reasons (see in appendix 3). The farmers objection then was accommodated by researchers and letting farmers to do what they think appropriate to their condition.

2.2 Establishment of participatory demplots

Dissemination were conducted in three important lowland shallot production in Brebes, Yogyakarta and Nganjuk. Initially, two demonstrating plots in Brebes, one demonstrating plot in Yogyakarta and one demonstrating plots in Nganjuk were established. These demonstrating plots were called as a participatory demonstrating plots because the establishment of demonstrating plots involving active participation of three actors i.e. researchers, key farmers and seed company of EWSI as presented in Table 1.

Table 1. Contribution of actors to the establishment of participatory demplots

Contribution	Actors and contribution items		
	Researchers of Ivegri & PPO	**EWSI**	**Key farmers**
Material	Fertilizer,	Seed	Land
	pesticides,		
	Seed bulb		
	Stable manure		
	Plastic cover and shading		
	Bamboo		
	Others		
Non material	Laboratory soil test	Selecting key farmers	Labour for: Land preparation
	Demplot design	Packing and distributing seed	
	Standard Operating Procedures (SOP)	Assist farmers to carry out demplot and collect data	nursery, transplanting, crop maintenance
	Monitoring and Supervision		
	Data collection		
	Data anlysis		
	Reporting		

2.3 Design of demplots

Demonstrating plots consisted of three main activities: 1) production of seedlings for transplanting in field production demonstrating plot of TSS, 2) demonstrating plot of field production of TSS, and 3) demonstrating plot of TSS nursery. Standard operating procedures and design of demonstrating plots are presented in appendix 1 and 2.

2.4 Monitoring and supervision

Monitoring and supervision in terms of visiting the key farmers and their demonstrating plots were conducted twice in each demonstrating plot, firstly during nursery of seedling production and secondly during the crops growing in production field. Monitoring and supervision were also conducted by cellphone (telephone and short message service) intensively during the establishment of the demplots. Monitoring included evaluation of the condition and growth of seedlings and crops in the demplots, climate condition, and attack of pest and diseases. Supervision and advice were given related to the farmers' questions about possible changes and improvements of techniques of seed sowing, seed density to sow, diseases control, frequency, timing and dosages of fertilizer application.

2.5 Field days

Field days were conducted in four locations, 2 in Brebes and 2 in Nganjuk on different dates. In each demplot location 30 target farmers, farmers who were interested in growing TSS,

surrounding demplot location were invited with the help of key farmers and Eastwest field staffs. In the field days, discussion with farmers was conducted, posters (appendix 3) were showed up and leaflets (appendix 4) were distributed. In the field days, farmer participants were asked to do as follows:

- to evaluate the performances of the crops (the crops growth and the resistance to pest and diseases) and the quality of tubers (the size of tubers, the colour of tubers and the acceptance by the market)
- to express their preferences to the different techniques of nursery and in field production demplots.

Farmers evaluation and preferences were recorded in a questionnair distributed during the field days. The questionnair was used as follows:

Farmer's evaluation on the characteristics of crops of different treatments in demplots

"What is your opinion to the characteristics of crops in beds no.1 to no. 9? "**:**

A. Very good
B. Good
C. Medium
D. Bad
E. Very bad

Farmers filled in their answer (A, B, C, D, or E) in the form as shown in Table 2.

Pictures 2, 3 and 4. Dissemination in Brebes

Presentation of research results

Farmers evaluation on demoplot of field production

Farmers evaluation on demoplot of nursery

Table 2. Form to fill in by farmers during evaluation the demplots.

Beds number	**Characteristics of the crops in demplot**				
	The crops growth **x1**	Resistance to pest & diseases **x2**	Size of tuber **x3**	Colour of tuber **x4**	Easy to sell **x5**
No. 1					
No. 2					
No. 3					
No. 4					
No. 5					
No. 6					
No. 7					
No. 8					
No. 9					

Farmer's rank of preferences to the crops performances in the field production demplots

"Based on your evaluation on the overall characteristics of the crops in bed number 1 to number 9, choose three best crops performances in bed numbers in rank order according to your preferences" :

Rank 1 : Crop in bed No. .....
Rank 2 : Crop in bed No. .....
Rank 3 : Crop in bed No. .....

Farmer's preference to the techniques of nursery in demplots

"Choose one technique of nursery you like best: (give X to the one you choose)"

Nursery with shelter		Nursery without shelter	
A	.....	A	.....
B	.....	B	.....
C	.....	C	.....
D	.....	D	.....
E	.....	E	.....
F	.....	F	.....
G	.....	G	.....

2.6 Data collection

Agronomic and economic data of demplot were collected from key farmers using farm record and interview with key farmers. The agronomic data were number of seedling per row or number of seedlings per 0.0625 m2 for Tuktuk and Sanren, yield of shallot per 10 m2 from different treatment in field production demplot, quantity and price of inputs used for seedling and crop production in demplots. Data on farmers' preference to the different treatments in nursery and crop production demplots were collected from the questionnair distributed to individual farmer participant during the field days.

2.7 Data analysis

agronomic aspect:

$$\text{Seed efficiency} = \frac{\text{number of seedlings per row}}{300 \times 2} \times 100\% \quad \text{.....(1)} \quad \text{or}$$

$$= \frac{\text{number of seedlings per 0.0625 m2}}{(30000)\,(0.0625/5)} \times 100\% \text{ .....(2)}$$

Yield = weight of shallot with leaves harvested from 10 m2 of bed and dried for 5 days (kg).

Economic aspect

Profitability of growing TSS versus bulb seed

Pi = R - (FC + VC)

Where:
i = crop in bed no.i
i = 1,2.....9

P = profit (IDR per 1600 m2)
R = Yield per 1600 m2 (kg) x selling price (IDR/kg)
FC = capital interest + land rent
VC = Input (unit) x Price of input (IDR/unit)
Inputs = planting material, fertiliser, labour, pesticides, depresiation of shelter and plastic cover

Interpretation:

- P from TSS < P from traditional tuber seed ----------> Profit from from TSS is less than that from traditional bulbseed
- P from TSS > P from traditional tuber seed ----------> Profit from from TSS is more than that from traditional bulbseed

Pictures 5, 6 and 7. Dissemination in Nganjuk1

Presentation of research results

Farmers evaluation on demoplot of field production

Farmers evaluation on demoplot of nursery

Farmers evaluation

Farmers evaluation data was scored from 1 (very bad) to 5 (very good). The minimum total score for 5 characters in Table 2 were 5 and the maximum total scores was 25. The range of score was 5 - 25. The farmers evaluation was categorised into 5:

$$FEk = \sum_{i=1}^{5} xki \quad \text{.....(3)}$$

where:

FE = Farmers' evaluation score
k = bed number, k = 1, 2, ...9
x i = score of the crops' character of i in bed number k
i = 1, 2,.....6

Scores	**Categories**
≤ 5	Very bad
> 5 - 10	Bad
>10 - 15	Medium
> 15 - 20	Good
> 20 - 25	Very good

Farmers preferences to the best crops growing in the demplot field

Choose three best crops performance

Farmers' preferences were scored from 1 to 3. The scores were as follows:

The first rank choice = 3
The second rank choice = 2
The third rank choice = 1

Farmers preferences to the techniques of TSS nursery

No score was given since farmers only choose one technique they like best

Pictures 8, 9 and 10. Dissemination in Nganjuk2

Presentation of research results

Farmers evaluation on demoplot of field production

Farmers evaluation on demoplot of nursery

3 Results and discussions

3.1 Weather conditions and diseases attack

The demplots were established from April to August 2010 (Table 3). Dry weather was expected, because this period is in the dry season. Unfortunately, the weather condition in 2010 changed completely from the usual. Usually dry season start from April and end in October. But in 2010 until mid of July hard rain still occurred quite often in all demplots locations. Anthracnose, *Peronospora destructor, fusarium* and alternaria diseases attacked TSS nursery and crops in the field production. Various fungicides recommended by researchers such as Amistar Top, Daconil and Ridomil were applied intensively. But still, two from six key farmers failed to continue establishing their demplots. One farmer failed because his nursery was damaged, while another farmer failed in the field production.

Because of too much rain all farmers changed the fertilizer recommendation by reducing the dosage or frequency application. The reasons of farmers were more or less the same for all farmers. Too much nitrogen fertilizer in rainy condition will make the crop too big and weak which was easily attacked by diseases. Combined with a high humidity around the leaf crops because the crops was too big and no wind blows, this would be a good environment for disease development.

Table 3. Dates of sowing, transplanting and harvesting

	Brebes		Nganjuk1		Nganjuk2	
	Dates	Ages (days)	Dates	Ages (days)	Dates	Ages (days)
Sowing	11 April	0 days	17 april	0 days	27 april	0 days
Planting						
TSS Tuktu	25 May	44 days	29 May	42 days	12 June	46 days
TSS Sanren	26 May	45 days	1 June	45 days	12 June	46 days
Bulb Local variety	10 June		9 June		19 June	
Bulb F2 Sanren			9 June		19 June	
Direct sowing					13 June	
Harvesting						
TSS Tuktuk	10 August	77 days	7 August	70 days	29 August	78 days
TSS Sanren	10 August	76 days	8 August	68 days	29 August	78 days
Bulb Local variety	10 August	61 days	8 August	60 days	18 August	60 days
Bulb F2 Sanren			8 August	60 days	18 August	60 days
Direct sowing					14 Sept	92 days

3.2 Seed efficiency

Data showed that in the first sowing the seed efficiency obtained from broadcasting techniques was higher than that from techniques of sowing seed in rows (Table 4). But this does mean that sowing seed by broadcasting techniques was better than sowing seed in

rows, because weather condition or rain will have a significant effect on the seed efficiency. In the second sowing, when the rain reduced, the seed efficiency from sowing seeds in rows was comparable to that of sowing seed in broadcasting. However, this data showed the fact that sowing seed by broadcasting, which was adopted from local practices, was a valid option as a techniques of sowing TSS.

Table 4. Techniques of sowing and seed efficiency

Sowing techniues	area of seed sown m2	amount of seed sown	Number of seedling Tuk2	Seed` efficiency Tuk2 (%)	Number of seedling Sanren	Seed` efficiency Sanren (%)
Broadcasted						
Nganjuk1 (Wono)						
Seed sown sample	6	30000				
(0.25x0.25)	0.0625	313	81	**26**	45	**14**
sample 5 gr seed	1	1500	-	-	-	-
Nganjuk2 (Puji)						
Seed sown	10	30000				
sample (0.5x0.5)	0.25	750	615	**82**	395	**53**
sample 5 gr seed	1	1500	782	**52**	762	**51**
Nganjuk3 (Nyono)						
Seed sown sample	5	30000				
(0.25x0.25)	0.0625	375	109	**29**	164	**44**
sample 5 gr seed	1	1500	567	**38**	677	**45**
In rows						
Brebes1 (Kapandi)						
Seed sown (m long)						
- first sowing*)	1	600	19	**3**	54	**9**
- second sowing	1	300	-	**-**	186	**62**
Brebes2 (Yus)						
- first sowing *)	1	600	50	**8**	50	**8**
- second sowing		600		-	253	**42**
Yogyakarta (Nardi)						
- first sowing*)	1	600	0	0	0	0
- second sowing*)	1	600	0	0	0	0

Notes: *) low seed efficiency due to damage in nursery by rain and diseases

3.3 Cost of nursery

To see the comparison of cost of nursery in three locations, calculation was made on the basis of sowing for one kg TSS. In three locations the cost of nursery for 1 kg TSS ranged from IDR 1,345,554 to IDR 1,595,634 with the average of IDR 1,465,535 (Table 5). Based on this calculation, it was estimated that the cost of production for one single seedling was IDR 16.5 to IDR 28.9 depended on the seed efficiency obtained. The higher the seed efficiency the cheaper the cost production per seedling (Table 6 and Graph 1).

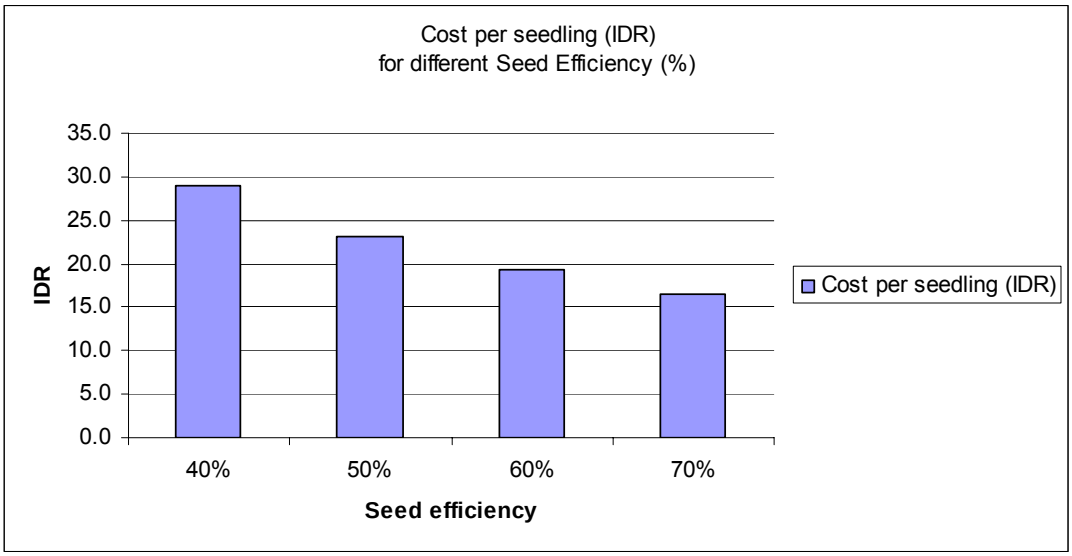
Table 5. Cost of nursery in 3 locations at farmers' level

	Brebes	**Nganjuk1**	**Nganjuk2**	**Average**
Amount of TSS sown (gr)	800	1,300	1,300	1,133
Area of nursery (m2 netto)	80	84	130	98
Labour				
Land preparation	171,000	280,000	245,200	232,067
Sowing (rowing beds, sowing, covering with soil, putting cover)	190,000	60,000	80,000	110,000
Making shelter	60,000	80,000	200,000	113,333
Maintenance (watering, spraying and weeding)	520,000	416,250	495,000	477,083
	941,000	836,250	1,020,200	932,483
Materials				
Bamboo and plastics (to be used for twice)	155,000	411,500	348,750	305,083
Pesticides	133,650	61,470	286,950	160,690
Fertilizer	24,000	380,000	199,000	201,000
	312,650	852,970	834,700	666,773
Other costs				
Land rent (2 months); 12 million IDR per ha per year	22,857	60,000	37,143	40,000
Total cost of nursery	1,276,507	1,749,220	1,892,043	1,639,257
Total cost of nursery for 1000 gr TSS	1,595,634	1,345,554	1,455,418	**1,465,535**

Table 6. Cost of production per seedling at farmer's level

Number of seed in 1 kg TSS	300,000	
Cost of nursery	1,465,535	rp/kg
Cost of seed (Sanren)	2,000,000	rp/kg

Seed Efficiency(%)	Seedling established per kg TSS sown #	Cost per seedlings IDR/seedling
40	120000	28.9
50	150000	23.1
60	180000	19.3
70	210000	16.5



Graph 1. Cost production per seedling for different seed efficiency (seed price: 2.000.000 IDR/kg)

3.4 Economic efficiency of TSS Sanren over local bulb seed

Cost of seedlings per hectare based on seed efficiency and plant density was shown in Table 7. The higher the plant density the more expensive the cost of seedlings. It was estimated that the cost of seedlings for plant density of 75 plants/m2 ranged from IDR 10.1 million per hectare to IDR 12.1 million per hectare depended on the seed efficiency.

Costs of local bulbseed per hectare varied according to the price of the bulbseed (Table 8). Compared with the costs of local bulbseed, the cost of TSS planted in 75 plants/m2 was cheaper than that of the cost of bulbseed at any price of local tuber seed. But if TSS seedlings were planted in 150 plants/m2, the cost of TSS was higher than that of local seed bulb crop if the price of local tuber seed was IDR 10000 per kg (Table 9). The costs of TSS planted at 150 plants/m2 was the same as costs of seed bulbs if the seed bulb price was IDR 15.000 per kg. If the price of seed bulbs was IDR 20000 per kg the costs of TSS planted at 150 plants per m2 were lower than the costs of seed bulb.

Table 7. Cost of seedlings per hectare based on seed efficiency (SE) and plant density (IDR/ha); seed price: 2.000.000 IDR/kg

SE (%)	Plant per m2	Spacing	Seedling needed per ha	TSS needed	Cost of seed	Cost of nursery (10^6 IDR)	Cost of seedlings (10^6 IDR/ha)
	#	(cmxcm)	#	(kg)	(10^6 IDR)		
50	75	13.3 x 10	525000	3.5	7.0	5.1	12.1
	100	10 x 10	700000	4.7	9.3	6.8	16.2
	125	8 x 10	875000	5.8	11.7	8.5	20.2
	150	6.7 x 10	1050000	7.0	14.0	10.3	24.3
60							
	75	13.3 x 10	525000	2.9	5.8	4.3	10.1
	100	10 x 10	700000	3.9	7.8	5.7	13.5
	125	8 x 10	875000	4.9	9.7	7.1	16.8
	150	6.7 x 10	1050000	5.8	11.7	8.5	20.2

Table 8. Variation of cost of seedbulb of local variety per hectar (IDR/ha)

	Seedbulb dormancy (months)	Seedbulb size	Seedbulb rate (kg/ha)	Seedbulb price (IDR/kg)	Cost of seedbulb (10^6 IDR/ha)
Brebes1	3	medium	1980	10000	19.8
Brebes2	2	medium	1700	22000	37.4
Nganjuk1	8	medium	1400	22000	30.8
Nganjuk2	5	medium	1400	15000	21.0
Average	**4.5**	**medium**	**1620**	**17250**	**27.25**

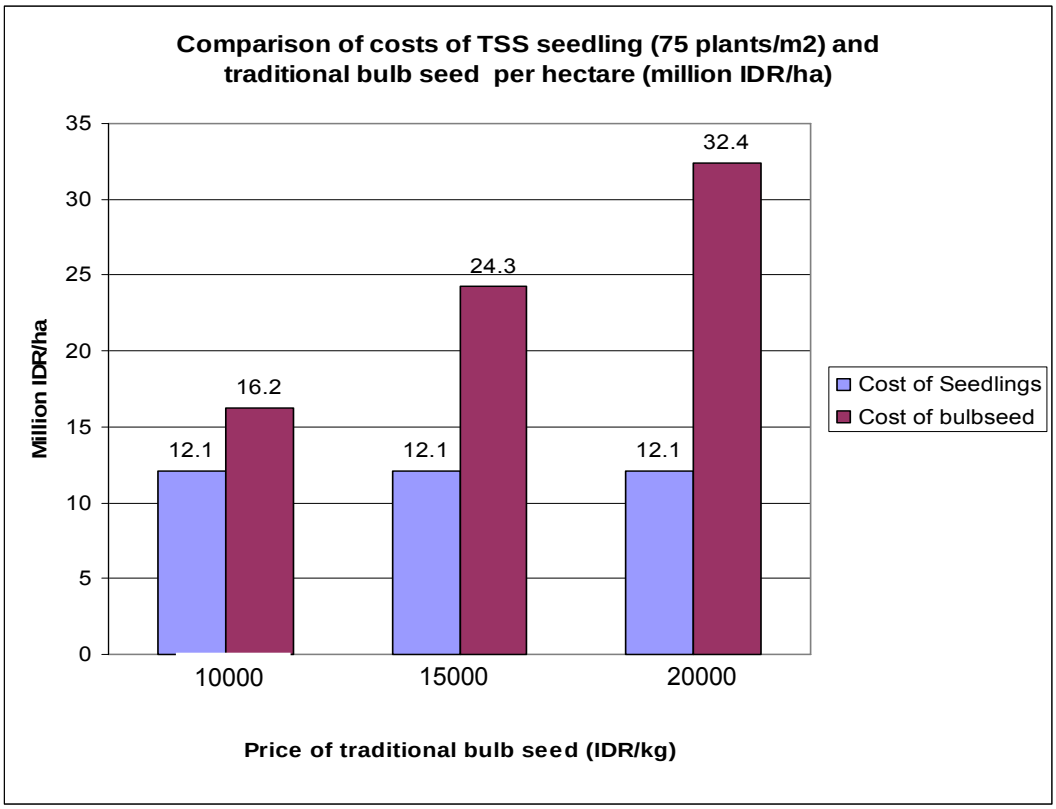
Table 9. Economic Efficiency of TSS Sanren over local seed at different price of local seed (10^6 IDR/ha)

Plant density	Cost of TSS seedlings	Seed bulb rate	Seed bulb Price	Cost of Seedbulb (10^6 IDR/ha)	Economic Efficiency of TSS*)
plant/m2	(10^6 IDR/ha)	(kg/ha)	(IDR/kg)		(10^6 IDR/ha)
75	12.1	1620	10000	16.2	-4.1
75	12.1	1620	15000	24.3	-12.2
75	12.1	1620	20000	32.4	-20.3
150	24.3	1620	10000	16.2	+ 8.1
150	24.3	1620	15000	24.3	0
150	24.3	1620	20000	32.4	-8.1

Notes:
Assumptions:

- seed efficiency = 50%

*) - = cost saving of TSS
+ = extra cost for TSS



Graph 2. Comparison of costs of seedlings and bulb seed (million IDR per ha) for different price of local bulb seed

3.5 Yield of TSS and local bulb seed

In Brebes, yield of local bulb seed of Bima Curut variety was higher than those of Tuktuk and Sanren. But, in Nganjuk the yields of Sanren and Tuktuk were higher than that of local bulb seed of Thailand variety (Table 10). Considering that during the period of the demoplots establishment the weather condition was very bad, hard raining was very frequently occurring, at least two reasons could explain this situation:

- Firstly, local variety of Bima Curut in Brebes was more resistant to the damage caused by rain than the local variety of Thailand in Nganjuk.
- Secondly, Tuktuk and Sanren crops were easily damaged by rain. In Brebes, Sanren and Tuktuk crops suffered from the rain longer than those in Nganjuk. In Brebes the demplot was established earlier when more rain was coming, meanwhile the demplots in Nganjuk were established in one to two weeks later when the rain was less. Therefore, the damage of Sanren and Tuktuk crops in Brebes were higher than those in Nganjuk. Due to the bigger damage, the yield of Sanren and Tuktuk in Brebes were lower than those in Nganjuk.

For TSS Tuktuk, plant density and dosage of N fertilizer have an effect on the yield. In all locations the yield of TSS Tuktuk planted in 150 plants/m2 were higher than that planted in 75 plants/m2. The yield of TSS Tuktuk with 240 N/ha was higher than that with 120 kg N/ha.

For TSS Sanren, effect of plant density on the yield was not consistent. In Brebes, the yield of TSS Sanren planted in 60 plants/m2 (plot9), 75 plants/m2 (plot 4) and 150 plants/m2 (plot 6) were 26.3 kg/10m2, 18.3 kg/10m2 and 20.4 kg/10m2. In Nganjuk1, the yield of TSS

Sanren planted in 150 plants/m2 (plot 6 and 7) were lower than that of planted in 75 plants/m2 (plot 4 and 5); in contrast in Nganjuk2 the yield of TSS Sanren planted in 150 plants/m2 was higher than that planted in 75 plants/m2. But, the effect of dosage of N fertlizer on the yield of TSS Sanren was consistent. In all locations, the yield of TSS Sanren with 240 kg N/ha was higher than that with 120 kg N/ha.

Table 10. Yield of TSS and local bulb seed

Plots number	Treatments	Yield (kg/10 m2) (dried in 7-8 days)		
		Brebes	Nganjuk1**)	Nganjuk2
1	Tuktuk 6,7 x 10 cm + 240 kg N/ha	**12.9**	22.3	42
2	Tuktuk 13,3 x 10 cm + 240 kg N/ha	9.4	16.3	25
3	Tuktuk 6,7 x 10 cm + 120 kg N/ha	10.2	18.7	31
4	Sanren 13,3 x 10 cm + 120 kg N/ha	18.3	27.5	33
5	Sanren 13,3 x 10 cm +240 kg N/ha	**19.3**	32.0	34
6	Sanren 6,7 x 10 cm + 120 kg N/ha	20.4	23.8	39
7	Sanren 6,7 x 10 cm + 240 Kg N/ha	**20.5**	**24.9**	**43**
8	Direct seeding Sanren + 120 kg N/ha	-	-	22
9	Sanren 16 x 10 cm + 120 kg N/ha	**26.3**	-	-
10	Local tuberseed (k cm x l cm)*) + 120 kg N/ha	**27.1**	**17.4**	**32**
11	Sanren tuber seed (F2) + 120 kg N/ha	-	31.9	44

Notes:

- = no such treatment

*) spacing of local tuber seed:

- in Brebes = 10 cm x 16 cm
- in Nganjuk1 = 10 cm x 13 cm
- in Nganjuk2 = 10 cm x 15 cm

**) estimated from weight after 22 days dried

3.6 Field days

Profil of participants

A total of 68 farmers attended in the field days consisted of 27 farmers in Brebes, 20 farmers in Nganjuk1 and 21 farmers in Ngajuk2. The ages of most of participants ranged from 25 – 54 years old, with formal education of junior and high school, mostly small farmers (<0.5 ha farming scale), and had experiences in growing shallot more than 10 years (Table 11).

About 62% of the participants already had experiences in growing TSS mostly once or twice, some three and four times. Farmers mentioned that they had success and failure experiences in growing TSS. The success meant that they were able to harvest shallot from TSS, and failures meant they could not harvest the shallot. The failures occurred both in the nursery and in the field production (Table 12).

Table 11. Characteristics of field days participants

Characeristics of participants	Brebes n= 27	%	Nganjuk 1 n= 20	%	Nganjuk 2 n=21	%	Total n=68	%
Ages (years)								
<25	1	4	0	0	0	0	1	1
25-34	10	37	6	30	3	14	19	28
35-44	8	30	7	35	7	33	22	32
45-54	5	19	5	25	8	38	18	26
≥ 55	3	11	2	10	3	14	8	12
no response	0	0	0	0	0	0	0	0
Formal education								
Elementary school	8	30	6	30	3	14	17	25
Junior school	6	22	3	15	5	24	14	21
High school	9	33	10	50	7	33	26	38
University	2	7	0	0	2	10	4	6
no response	2	7	1	5	4	19	7	10
Scale of shallot farming (ha)								
0.10-0.19	3	11	6	30	3	14	12	18
0.20-0.29	1	4	9	45	2	10	12	18
0.30 - 0.39	3	11	0	0	0	0	3	4
0.40 - 0.49	0	0	1	5	0	0	1	1
≥ 0.5	10	37	2	10	5	24	17	25
no response	10	37	2	10	11	52	23	34
Experiences in growing shallot (years)								
< 5	2	7	4	20	4	19	10	15
5-9	2	7	1	5	2	10	5	7
10-14	6	22	4	20	3	14	13	19
15-19	6	22	4	20	2	10	12	18
≥ 20	6	22	7	35	4	19	17	25
No response	5	19	0	0	6	29	11	16
Experiences in growing TSS (frequency)								
Never	12	44	11	55	19	90	42	62
Had tried								
- once	5	19	8	40	2	10	15	22
- twice	7	26	0	0	0	0	7	10
- three times	2	7	0	0	0	0	2	3
- four times	1	4	1	5	0	0	2	3

Table 12. Experiences of success and failures (%) in growing TSS

	Kapandi freq =29	Wono freq = 12	Puii freq = 2	Total freq = 43
Success	62	33	0	51
Failures				
- in nursery	24	17	50	23
- in the field production	14	50	50	26
Total percentage	100	100	100	100

Farmers evaluation on the characteritics of crops in demplots

The crops characteristics from TSS and local tuber seed

In Brebes, farmers valued that the crops characteritics (CC) from TSS both Tuk Tuk and Sanren were worse than that from local tuber seed. The CC scores of Tuk Tuk in plots 1, 2 and 3 in average was 5.5 (categorized as medium), Sanren in plot 4,5,6 and 9 in average was 5.8 (categorized as medium) while local tuber seed was 7.1 (categorized as good).

In contrast, farmers in Nganjuk1 and Nganjuk2 valued that the crops characteritics (CC) from TSS, particularly Sanren, was better than that from local tuber seed. In Nganjuk1, the CC scores of Tuk Tuk, Sanren and local tuber seed were in average 6.5 (medium), in average 7.2 (good) and 5.7 (medium). In Nganjuk2, the CC scores of Tuk Tuk, Sanren and local tuber seed were in average 7.3 (good), in average 8.3 (good) and 6.2 (medium).

The tuber characteristiscs from TSS and local tuber seed

In Brebes, farmers valued that the tuber characteristics (TC) from TSS both Tuktuk and Sanren were equal to that from local tuber seed. The TC scores of Tuktuk in plots 1, 2 and 3 in average was 9.0 (categorized as medium), Sanren in plot 4,5,6 and 9 in average was 9.7 (categorized as medium) while local tuber seed was 9.0 (categorized as medium).

In contrast, farmers in Nganjuk1 and Nganjuk2 valued that the TC from TSS, particularly Sanren, was better than that from local tuber seed. In Nganjuk1, the TC scores of Tuktuk, Sanren and local tuber seed were in average 10.4 (good), in average 11.7 (good) and 7.1 (bad). In Nganjuk2, the TC scores of Tuktuk, Sanren and local tuber seed were in average 11.6 (good), in average 12.3 (good) and 9.6 (medium).

The scores of farmers evaluation on the charactrisitics of crops and tubers in the demplots are presented in Table 13.

Table 13. Farmers evaluation on the crop characteristics (CC) and tubers characteristics (TC) of crops from TSS and local tuberseed in the demoplots

Plots number	Treatments	Brebes		Nganjuk1		Nganjuk2	
		CC Scores	TC Scores	CC Scores	TC Scores	CC Scores	TC Scores
1	Tuktuk 6,7 x 10 cm + 240 kg N/ha	5.8	9.6	6.1	10.0	7.8	11.6
2	Tuktuk 13,3 x 10 cm + 240 kg N/ha	5.8	8.1	6.8	10.0	7.0	11.6
3	Tuktuk 6,7 x 10 cm + 120 kg N/ha	5.0	9.2	6.6	11.2	7.0	11.6
4	Sanren 13,3 x 10 cm + 120 kg N/ha	5.1	9.0	6.8	11.5	7.7	12.3
5	Sanren 13,3 x 10 cm +240 kg N/ha	5.5	8.9	6.8	11.1	8.0	12.3
6	Sanren 6,7 x 10 cm + 120 kg N/ha	5.7	10.2	6.9	11.8	8.4	12.3
7	Sanren 6,7 x 10 cm + 240 Kg N/ha	**6.3**	**10.3**	**8.1**	**12.4**	**9.0**	**12.3**
8	Direct seeding Sanren + 120 kg N/ha	-	-	0	0	6.6	12.3
9	Sanren 16 x 10 cm + 120 kg N/ha	6.4	10	-	-	-	-
10	Local seed + 120 kg N/ha	**7.1**	**9**	**5.7**	**7.1**	**6.2**	**9.6**
11	Sanren tuber seed (F2) + 120 kg N/ha	-	-	6.5	12.2	7.3	12.3

Notes:
CC = crops characteristics (the crop growth and resistance to pest and diseases)
TC = tuber characteristics (tuber size, colour and acceptance by market)

CC categories	Scores	TC categories	Scores
very bad	1.8 - 3.4	very bad	2.8 - 5.2
bad	3.5 - 5.1	bad	5.3 - 7.7
medium	5.2 - 6.8	medium	7.8 - 10.2
good	6.9 - 8.5	good	10.3 - 12.7
very good	8.6 - 10.2	very good	12.8- 15.2

Farmers preferences on the characteristics of crops in demplots

Based on the evaluation of all characteristics of the crops, farmers in all locations more preferred to Sanren than those of Tuktuk and local tuber seed. In Brebes, the percentages of farmers who preferred to Sanren, Tuk tuk and local tuber seed were 76%, 4% and 20% respectively. In Nganjuk1 and Nganjuk2 no farmers preferred to local seed. Mostly preferred to TSS Sanren, some preferred to tuber seed of Sanren and only a few preferred to Tuktuk. In Nganjuk1, the percentages of farmers who preferred to Sanren, Tuktuk and tuber seed of Sanren were 74%, 7% and 20% respectively. In Nganjuk2, the percentages of farmers who preferred to Sanren, Tuktuk and local tuber seed were 76%, 4% and 20% respectively (Table 14).

Among the treatments, most farmers in Brebes preferred to Sanren planted in 60 plants/m2 (plot 9), meanwhile farmers in Nganjuk preferred to Sanren planted in 150 plants/m2 (plot 7).

In Nganjuk1 and Nganjuk2, the farmers preferences were in accordance with the farmers evaluation on the CC and TC (Table 13). The highest scores of CC and TC in Nganjuk were for plot 7. But in Brebes the farmers preferences were a slightly different with their evaluation n the CC and TC. The highest scores given by farmers in Brebes was the same as those farmers in Nganjuk1 and Nganjuk2, i.e. Sanren planted in 150 plants/m2.

Table 14. The treatment in the demoplots most preferred by farmers

No bed	Treatments	**Brebes** n=25		**Nganjuk1** n=15		**Nganjuk2** n=20	
		#	%	#	%	#	%
1	Tuktuk 6,7 x 10 cm + 240 kg N/ha	0	0	1	7	1	5
2	Tuktuk 13,3 x 10 cm + 240 kg N/ha	0	0	0	0	0	0
3	Tuktuk 6,7 x 10 cm + 120 kg N/ha	1	4	0	0	1	5
4	Sanren 13,3 x 10 cm + 120 kg N/ha	0	0	4	**27**	0	0
5	Sanren 13,3 x 10 cm +240 kg N/ha	0	0	0	0	1	5
6	Sanren 6,7 x 10 cm + 120 kg N/ha	4	16	1	7	2	10
7	Sanren 6,7 x 10 cm + 240 Kg N/ha	4	16	**6**	**40**	**12**	**60**
8	Direct seeding Sanren + 120 kg N/ha	**-**	**-**	**-**	**-**	0	0
9	Sanren 16 x 10 cm + 120 kg N/ha	**11**	**44**	**-**	**-**	**-**	**-**
10	Local seed + 120 kg N/ha	5	20	0	0	1	5
11	Sanren tuber seed (F2) + 120 kg N/ha	**-**	**-**	3	20	2	10

Farmers preferences to the techniques of TSS nursery

In all locations, technique of sowing seed in rows, 1 cm depth and covered with soil, and using plastic shading was the technique most preferred by farmers compared to other techniques (Table 15). Farmers considered that the technique was easy to be done and the percentage of seedlings establishment was better than the other techniques.

Table 15. Sowing techniques and number of farmers preferred (%)

Plots Codes	Sowing techniques	Brebes (n=23)		Nganjuk1 (n=14)		Nganjuk2 (n=15)		Total (n =52)	
		NSh %	Sh %	NSh %	Sh %	NSh %	Sh %	NSh %	Sh %
A	In rows, 1 cm depth, covered with soil	26	35	7	79	33	53	23	52
B	In rows, 0.25 cm depth, covered with soil	0	9	7	0	0	7	2	6
C	In rows, 1 cm depth, covered with fermented rice husk	0	9	0	0	0	0	0	4
D	In rows, 1 cm depth, covered with fermented rice husk	0	13	0	0	7	0	2	6
E	Broadcasted	4	0	0	0	0	0	2	0
F	In trays, media: soil:sand: manure (1:1:1)	0	0	7	0	0	0	2	0
G	In trays, media: soil:sand: manure (1:1:1)	0	0	0	0	0	0	0	0
	No response	4	0	0	0	0	0	2	0

Notes:
NSh = no shading
Sh = shading

Picture 13. Nursery demo in Brebes in 2010.

3.7 Farmers' interest to try out TSS

More than 50% famers mentioned that they were interest to grow TSS. About 25% of farmers mentioned that they were still considering to grow TSS and no farmers mentioned that they did not interest to grow TSS (Table 16). Number of farmers who attended the field days and had already experiences in growing TSS in Brebes, Nganjuk1 and Nganjuk2 were 56%, 45% and 10%. After attending the field day, number of farmers who interested in growing TSS in Brebes, Nganjuk1 and Nganjuk2 were 61%, 36% and 53%. It seemed the number of farmers who interest in growing TSS significantly increased in Nganjuk2, slightly increased in Brebes, and decreased in Nganjuk2. Further monitoring is needed to confirm this data.

Table 16. Number of farmers interest in growing TSS in 3 locations (%).

Interest	Locations							
	Brebes (n=23)		Nganjuk1 (n = 14)		Nganjuk2 (n=15)		Total (n = 52)	
	Freq	%	Freq	%	Freq	%	Freq	%
Yes	14	61	5	36	8	53	27	52
Consider	3	13	7	50	3	20	13	25
No	0	0	0	0	0	0	0	0
No response	6	26	2	14	4	27	12	23
Total	23	100	14	100	15	100	52	100

3.8 Latest progress of TSS adoption

Until the first week of November 2010, the progress of TSS adoption in 3 locations were as follows:

- In Brebes, 6 farmer participants tried out Sanren but all failed due to damage by rain
- In Nganjuk1, 3 farmer participants bought a total of 2.5 kg seed of Sanren and the seed will be sown in the end of November. Besides that, 4 other farmer participants tried to grow bulb seed of Sanren.
- In Nganjuk2, 9 farmer participants bought a total of 5 kg seed of Sanren and sowed in end of October. Besides that 3 farmer participants also bought a total of 600 kg bulb seed of Sanren, of which one farmer also tried out TSS.
- Further monitoring is needed to evaluate the process of TSS adoption in the three locations.

Picture 5. Nursery on seedbed in the field with shelter.

4 Conclusions and recommendations

Conclusions

- At farmers level, using TSS as planting material was cheaper than that of using traditional tuber seed.
- Cost of seedling for planting TSS Sanren in 75 plants/m2 was cheaper than that of costs of traditional tuber seed if the price of the tuber seed was IDR 10000/kg or more. But for planting in 150 plants/m2, it was cheaper only when the price of local tuber seed was more than IDR 15000/kg.
- Under rainy condition, the average yield of TSS Sanren was higher than that of TSS Tuktuk, but it could be higher or lower than that of local tuber seed. The yield of TSS Sanren would be higher if the local tuber seed was more susceptible to the damage of the rain, and could be lower if the local tuber seed was more resistant to the damage of the rain.
- For TSS Tuktuk, at farmers level and under rainy condition, high plant density (150 plants/m2) and high dosage of N fertilizer (240 kg N/ha) gave a higher yield than that of low density (75 plants/m2) and low dosage of N fertilizer (120 kg N/ha).
- For TSS Sandren, the effect of plant density on yield was not consistent. But the effect of N fertilizer application on yield was clear. The yield of TSS Sanren with 240 kg N/ha was higher than that of with 120 kg N/ha.
- Farmers preferred TSS Sanren to TSS Tuktuk because they valued that the characteristics of TSS Sanren in terms of crops growth, resistance to pest and diseases, tuber size, tuber colour and market acceptance were better than that of TSS Tuk Tuk.
- In the nursery, farmers preferred sowing the seed in row, with sowing depth of 1 cm, covering the row with soil or mixture of soil and stable manure and putting a shelter over the nursery. Farmers perceived that the technique was practical and gave optimum seed efficiency.
- In the field production, farmers in Brebes preferred to plant TSS Sanren in 60 plants/m2 with 120 kg N/ha, while farmers in Nganjuk preferred to plant TSS Sanren in 150 plants/m2 with 240 kg N/ha.
- Through observation and evaluation on farmers' participatory demplots, about 52% of farmers participant in the field days admitted that they were interested to try out TSS and some of them continue with a small trial on TSS Sanren.
- Methods of farmers-participatory demplots was an effective way to disseminate TSS technology to farmers in terms of:
    - Providing farmers with practical aspects of TSS technology
    - Arising farmers' awareness and interest of TSS technology
    - Giving farmers opportunity to evaluate the benefits and disadvantages of TSS technology
    - Stimulating farmers to try out TSS technogy in small scale

Recommendations:

- TSS Sanren is recommended to be introduced to farmers as an alternative of traditional tuber seed.
- TSS Sanren is recommended for planting in dry season only.
- In the nursery, it is recommended to sow the seed in row, in 1 cm depth, cover the row with soil and using shelter.
- In the field production the effect of plant density and dosage of N fertilizer on the yield of TSS Sanren needed to be confirmed in further experiments.

- To disseminate TSS Sanren to farmers it is recommended do it by using farmers' participatory demplots.

Appendix 1

Design of demplots field production

1	2	3	4	5	6	7	8	9
Tuk2 Planted: 1st 240 kg N spacing: 10 cm x 6,7 cm	**Tuk2** Planted: 1st 240 kg N spacing: 10 cm x 13,3 cm	**Tuk2** Planted: 1st 120 kg N spacing: 10 cm x 6,7 cm	**Sanren** Planted: 1st 120 kg N spacing: 10 cm x 13,3 cm	**Sanren** Planted: 1st 240 kg N spacing: 10 cm x 13,3 cm	**Sanren** Planted: 1st 120 kg N spacing: 10 cm x 6,7 cm	**Sanren** Planted: 1st 240 kg N spacing: 10 cm x 6,7 cm	**Sanren** sowed: 1st 120 kg N spacing: 10 cm between rows	**local seed** Planted: 21st 120 kg N spacing: 15 cm x 20 cm

length of beds 20 m

Design of demplots field production

fertiliser application	1	2	3	4	5	6	7	8	9
- 2 days	70gr SP18/m2	70gr SP18/m2	70gr SP18/m2	70gr SP18/m2	70gr SP18/m2	70gr SP18/m2	70gr SP18/m2	70gr SP18/m2	70gr SP18/m2
+ 2 weeks	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	0	25 g NPK/m2
+ 3 weeks	25 g NPK/m2	25 g NPK/m2	0	0	25 g NPK/m2	0	25 g NPK/m2	0	0
+ 4 weeks	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2
+ 5 weeks	25 g NPK/m2	25 g NPK/m2	0	0	25 g NPK/m2	0	25 g NPK/m2	0	0
+ 6 weeks	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2	25 g NPK/m2
+ 6 weeks	12,5 gr KCl/m2	12,5 gr KCl/m2	12,5 gr KCl/m2	12,5 gr KCl/m2	12,5 gr KCl/m2	12,5 gr KCl/m2	12,5 gr KCl/m2	0	12,5 gr KCl/m2
+ 7 weeks	25 g NPK/m2	25 g NPK/m2	0	0	25 g NPK/m2	0	25 g NPK/m2	0	0
+ 8 weeks	0	0	0	0	0	0	0	25 g NPK/m2	0
+ 8 weeks	0	0	0	0	0	0	0	12,5 gr KCl/m2	0

notes: - = before planting, + = after planting

Design of demplots of nursery

Bed 1	**Bed 2**
A= 20 rows	A= 20 rows
B = 20 rows	B = 20 rows
C = 20 rows	C = 20 rows
D = 20 rows	D = 20 rows
E = 2 m	E = 2 m
F = 4 trays	F = 4 trays
G = 4 trays	G = 4 trays

notes:
length of beds = **11** m
Bed **1** : plastic cover, open after 3 days; shelter
Bed **2** : no plastic cover, no shelter

Appendix 2

Standard operating procedures of seedling production, demplots of production field and nursery.

Procedures for seedling production

Procedures
Beds should be made as early as possible after wet season. At least one month of preparation of the top layer is needed to obtain a good sowing bed. If the quality of the seed bed is not good enough trays should be used
If available stable manure or compost should be mixed in the top layer (100 kg per 10 m2).
Control of soil insect in beds (molecricket, ants, other), 1-2 days before sowing, using a mixture of rice siftings + Dursban (5 kg rice sifting + 100 cc Dursban).
Before sowing 5 grams Carbufuran, 50 grams KCL and 200 grams SP18 per m2 will be mixed in the top layer.
Sowing will be done in rows 10 cm from each other; the furrow will be 1 cm deep; per 1 m rowlength 2 grams Tuktuk or 1.9 grams Hybrid (3000 seeds per m2).
Furrow will be closed with soil or with a mixture of soil and stable manure. It must be controlled if seed is covered with soil. The seed should be covered with 1 cm soil. After sowing watering should be done with a bruze (not too much).
the beds should be covered with plastic during 3 days until the seed germinted.
After removing the plastic sheet the nursery should be covered with a shelter to protect against heavy rain and sun light. The material for the shelter can be choosen by the farmer based on his experience.
Pest and diseases should be controlled as good as possible. (a.o. Amistar Top and Score and Tracer). Every day the nursery will be controlled.
Watering will be done each day carefully with a bruze two times a day: in the early morning and at the the end of the day.
Before transplanting the field should be watered very well and the soil under the rows should be lifted with a small spade before pulling the seeds out of the soil. The seedlings should be transplanted until 4 hours after harvesting in the nursery.

Procedures of field production demplot

Procedures
The beds should be prepaired very well, at least one month of preparation of the top layer
Lime should be given if pH is too low. Lime should be given as soon as possible.
Before transplanting 125 kg P2O5 should be given as SP18, 1 – 5 days before transplanting.
Transplanting will be done five or six week after sowing the nursery
The seedlings will be planted in rows 10 cm from each other. Distance in the row: 6,7 cm to get a plant density of 150 plants/ m2 and 13,3 cm to get a plant density of 75 plants/m2.
Rows should be made with a stick or shown with spots on a rope
Seedlings should be transplanted at the right depth (the base of the seedling should be 1,5 a 2 cm in the soil. Soil should be slightly pressed around the seedling.
The following beds of 20 m length should be transplanted: Tuktuk 150 plants per m2 and 240 kg N/ha Tuktuk 75 plants per m2 and 240 kg N/ha Tuktuk 150 plants per m2 and 120 kg N/ha Sanren 75 plants per m2 and 120 kg N/ha Sanren 75 plants per m2 and 240 kg N/ha Sanren 150 plants per m2 and 120 kg N/ha Sanren 150 plants per m2 and 240 kg N/ha
Watering during the first three weeks after transplanting should be done carefully with a bruze at least two times a day. Later on the traditional way of watering could be done.
At the same time as transplanting TSS one bed of 20 m length will be used for direct sowing. Sowing wil be done in rows 10 cm from each other, sowing depth 1 cm, closing the furrow with soil. Seed quantity 0.25 gram per 0,75 m row length.
Three weeks after transplanting TSS seed bulbs of the local seed bulb variety should be planted (15 cm x 20 cm)
The fertilization of the transplanted plots will be done as follows: 2 weeks after transplanting all plots: 40 kg N/ha (16+16+16) 3 weeks after transplanting only “240 kg plots” 40 kg N/ha (16+16+16) 4 weeks after transplanting all plots: 40 kg N/ha (16+16+16) 5 weeks after transplanting only “240 kg plots” 40 kg N/ha (16+16+16) 6 weeks after transplanting all plots: 40 kg N/ha (16+16+16)+ 75 kg KCL/ha 7 weeks after transplanting only “240 kg plots” 40 kg N/ha (16+16+16)
The fertilization of the plot with planted seed bulb of the local variety 2 weeks after planting: 40 kg N/ha (16+16+16) 4 weeks after planting: 40 kg N/ha (16+16+16) 6 weeks after planting: 40 kg N/ha (16+16+16) + 75 kg KCL/ha
The fertilization of the TSS direct sowing plot: 4 weeks after sowing: 40 kg N/ha (16+16+16) 6 weeks after sowing: 40 kg N/ha (16+16+16) 8 weeks after sowing: 40 kg N/ha (16+16+16) + 75 kg KCL/ha
Control of pests and diseases will be done as optimal as possible (a.o. Amistar Top and Score and Tracer)
Every two week the beds will be observed by local EWSI-people.

Procedures of seed nursery demplot

Procedures
Two beds of ca. 11 m length should be prepaired very carefully. At least one month of preparation of the top layer is needed to obtain a good sowing bed.
If available stable manure or compost should be mixed in the top layer (100 kg per 10 m2).
Control of soil insect in beds (molecricket, ants, other), 1-2 days before sowing, using a mixture of rice siftings + Dursban.
Before sowing 5 grams Carbufuran, 50 grams KCL and 100 grams SP18 per m2 will be mixed in the top layer.
Sowing will be done in rows 10 cm from each other; the furrow will be 1 cm deep; per 1 m rowlength 2 grams Tuktuk or 1.9 grams Sanren. (3000 seeds per m2).
The following treatments will be sown on each bed (It must be controlled if the seed is covered well with soil or rice husks): A. 20 rows (10 cm from each other) on a bed sown at a depth of 1 cm and furrow closed with soil. B. 20 rows (10 cm from each other) on a bed sown at a depth of 0,25 cm and furrow closed with soil C. 20 rows (10 cm from each other) on a bed sown at a depth of 1 cm and furrow closed with fermented rice husks D. 20 rows (10 cm from each other) on a bed sown at a depth of 1 cm, furrow closed with soil, without watering after sowing E. Broadcasted plot (To compare with the other treatments); 2,0 m length of a bed. (seed density will be calculated later on) F. 4 trays with nursery mixture 1 (paddy field soil: sandy soil: stable manure) sown 1 cm deep and furrow closed with mixture. G. 4 trays with nursery mixture 2 (the farmer can choose his own mixture) sown 1 cm deep and furrow closed with mixture
After sowing and watering 1 bed will be covered with plastic sheet which will be removed after 3 days. After these 3 days a shelter will be put over the bed to protect against heavy rain. The other bed will be uncovered.
The uncovered bed will be watered two times a day to keep the soil wet enough for germination of the seed (carefully with a bruze), at least two times a day: in the early morning and at the end of the day
Also on the other bed after removing the plastic sheet watering will be done carefully every day with a bruze at least two times a day: in the early morning and at the the end of the day.
Pest and diseases should be controlled as good as possible (Amistar Top, Ridomil, Daconil an Score). Every day the nursery will be controlled.

Appendix 3.

Farmer's responses on the SOP of demo

Key famer's name	Locations	Farmers' comments and objections	Improvements of the SOP
1. Kapandi, and 2. Yus B.	Brebes	Direct sowing in the field. They did not want to do it because: • labour cost • It will be harvested later than the other beds: maintaining only one bed is not efficient, difficult, and will be attacked by pest. Demo of nursery. They did not want to do it because: • There is no benefit for them; it is only for showing to other farmers. The seedlings can not be used; it is too late season for planting. No new information, they know already how to do the nursery. • They lost opportunity to make money from producing traditional shallot, because the land is occupied by the nursery.	1. Sowing in row to produce seedlings 2. Design of transplanting demo without direct sowing (treatment 1-7 & 9). 3. No demo of nursery (unless compensation is given)
3. Nardi	Yogyakarta	Agree with transplanting and direct sowing techniques recommended. Disagree with frequency of fertilizer application, too many and too late which will affect on high losses in storage. Disagree with nursery demos. Only willing to do the best sowing techniques: (sowing depth 1 cm and covering with burned rice husk) in beds and plastic trays. Note: in this location TSS will be planted in sand soil (near the beach). Covering seed after sowing with sand is not possible.	1. Sowing in row to produce seedlings 2. Design of transplanting as recommended + additional beds of farmer's fertilizer applications (only two times, the last is applied 15 days after planting) 3. Only one bed of nursery demo consists of two treatments (in beds and in trays: sowing in rows with 1 cm depth and cover with burned rice husk).
4. Nyono W. 5. Suwono 6. Puji S.	Nganjuk	Disagree with sowing techniques in rows. They failed to do it in previous season. They got the best results with sowing in broadcast. Agree with design of transplanting demo field including direct sowing. Interest to know the yield of tuber seed from TSS. Disagree with	1. Sowing in broadcast to produce seedlings 2. Design of demo transplanting as recommended + additional beds of tuber seed from TSS

Appendix 4. Posters

PRAKTIJKONDERZOEK PLANT & OMGEVING WAGENINGEN UR

BALITSA

Analisis usahatani bawang merah menggunakan benih Biji Botani Bawang Merah dan benih umbi

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Analisis usahatani

Perkiraan analisa usahatani bawang merah menggunakan benih Biji Botani Bawang Merah dan benih umbi dibuat berdasarkan situasi berikut ini:

- Luas usahatani 1600 m² bruto (termasuk selokan; 1120 m² neto)
- Harga benih umbi Rp. 15000,- per kg
- Luas persemaian di lapangan 140 m²
- Jumlah benih biji botani disemai: 3000 biji per m²
- Bobot benih biji botani per 1000 biji adalah 3 gram
- Harga benih biji botani: Rp 1.200.000,- per kg
- Efisiensi benih: 40%
- Persemaian diberi naungan plastik kasa
- Tanaman dari benih umbi dipanen: umur 8 minggu
- Tanaman dari benih biji botani dipanen: umur 11 minggu
- Hasil berdasarkan penelitian tahun 2008 dan 2009 di Brebes: Tuk Tuk 3830 kg/1600 m² dan Bima Curut 2250 kg/1600 m²
- Biaya tenaga kerja berdasarkan pencatatan yang dilakukan pada percobaan lapangan tahun 2008 (dan 2009). Mungkin dalam praktek sesungguhnya biaya tenaga kerja akan lebih efisien.
- Pestisida dihitung berdasarkan data percobaan. Mungkin dalam praktek sesungguhnya akan lebih rendah.
- Harga hasil Rp. 5000,- per kg, sama untuk hasil dari benih biji botani maupun benih umbi. Dalam prakteknya, harga tersebut mungkin berubah.

Perhitungan ini dimaksudkan untuk memberikan gambaran tentang adanya perbedaan biaya produksi. Jika kondisi berubah atau harga berubah dari situasi yang digunakan dalam perhitungan, maka perlu dilakukan perhitungan ulang.

Perbandingan biaya berubah usahatani bawang merah menggunakan TSS dan benih umbi untuk 1600 m²

URAIAN	BIAYA BERUBAH (x Rp 10.000)	
	TSS	BENIH UMBI
Persemaian/beli benih umbi		
Benih umbi (Rp. 15.000,-/kg, 325 kg)		489
Benih TSS*** (Rp. 1.200,- IDR/gr), 1,25 kg)	151	
Pupuk kandang (280 kg)	17	
Tenaga kerja*:		
Pengolahan lahan	39	
Penyemaian	11	
Pembuatan naungan	34	
Penyiraman/penyiangan/pemupukan/penyemprotan	22	
Bahan		
Naungan	49	
Pestisida	11	
Pupuk	3	
Produksi di lapangan		
Tenaga kerja*:		
Pindah tanam	60	10
Penyiraman/penyiangan/pemupukan/penyemprotan	167	121
Panen dan penjemuran	56	56
Pupuk kandang	54	54
Insektisida	324	257
Fungisida	50	40
Total biaya berubah	**1048**	**1027**
Hasil**	**1915**	**1125**

* Upah Tenaga Kerja Pria Rp. 25.000,-; Wanita Rp. 13000,-

** Berdasarkan hasil rata-rata Tuktuk, 2008/2009: 3830 kg, @ Rp. 5000,-/kg
Benih umbi, 2008/2009: 2250 kg, @ Rp. 5000,-/kg

*** Persemaian 140 m²; 3000 benih/m²; Efisiensi benih 40%; Kerapatan tanaman 150 tanaman/m²

Catatan: Perhitungan ini merupakan contoh. Jika kondisi berubah, maka harus dibuat perhitungan baru (harga benih, harga jual bawang, efisiensi benih)

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PRAKTIJKONDERZOEK PLANT & OMGEVING WAGENINGEN UR

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Persemaian di bedengan atau di baki

Dibandingkan dengan persemaian di baki, persemaian di bedengan mempunyai beberapa keuntungan dan kerugian yaitu:

- Biaya yang lebih murah (baki, tanah, pupuk kandang)
- Kebutuhan tenaga kerja lebih sedikit (membuat media persemaian, mengisi media di baki)
- Efisiensi benih lebih rendah (dalam percobaan efisiensi benih di bedengan mencapai 50% sedangkan di baki 82%)
- Tergantung pada kondisi tanah yang ada (setelah padi, kondisi tanah jelek); persiapan lahan harus dilakukan secara hati-hati.

Teknik untuk mendapatkan hasil persemaian yang optimal

Untuk mendapatkan hasil persemaian yang optimal, perlu dilakukan:

- Pemasangan naungan persemaian, untuk melindungi dari hujan deras dan terik matahari
- Pengendalian hama (orong-rong, spodoptera) dan penyakit (Anthracnose)
- Penyemaian dilakukan sebagai berikut:
  - * Di dalam garitan, dengan jarak garitan 7-10 cm
  - * Kedalaman semai 1 - 1,5 cm
  - * jumlah benih disemai: 3000 benih per m²
  - * Garitan harus ditutup dengan tanah atau media persemaian
  - * Agar benih dapat disemai merata dengan kedalaman yang tepat, benih harus kelihatan (misalnya, dicampur dengan beras menir)
- Penyiraman harus dilakukan 2-3 kali sehari secara hati-hati (menggunakan gembor air yg menghasilkan tetesan air yan kecil)

Pengaruh dari kedalaman semai dan pentupan menggunakan arang sekam dan tanah terhadap efisiensi benih (%)

	Percobaan 1		Percobaan 2	
	Arang sekam	Tanah	Arang sekam	Tanah
Di baki:				
0,25 cm	23	44	_	_
0,50 cm	33	67	25	55
1,00 cm	41	75	41	61
1,50 cm	44	81	_	_
Di bedengan:				
0,25 cm	25	31	_	_
0,50 cm	27	33	_	19
1,00 cm	24	35	_	23
1,50 cm	28	43	_	25

Perkiraan biaya persemaian

Biaya (Rp) persemaian di bedengan, untuk penanaman 1600 m², dengan luas persemaian 140 m2 (3000 benih/m², efisiensi benih 40%)

	Jumlah		Harga/unit	Total
Benih	1260	gr	1200	1512000
Pupuk kandang	280	kg	600	168000
Tenaga kerja*:				
Pengolahan lahan (P)	14,6	hari	25000	365000
Pengolahan lahan (W)	1,6	hari	13000	20800
Penyemaian (W)	4,66	hari	13000	60580
Penyemaian (P)	2	hari	25000	50000
Penyiraman (P)	7	hari	25000	175000
Penyemprotan (P)	0,2	hari	25000	4714
Penyiangan (W)	1,9	hari	13000	24512
Pemupukan (P)	0,8	hari	25000	18889
Pasang naungan (P)	13,6	hari	25000	340000
Biaya bahan:				
Bambu	17	stems	7500	127500
Kawat	1,7	kg	15000	25500
Plastik kasa	332	m	1000	332000
Dursban	3,4	btl	7000	23800
Dedak	1,7	paks	5000	8500
Traser	0,09	l	870000	73950
NPK	3,4	kg	9500	32300
Biaya Total				**3363044**

*: P= Pria; W = Wanita)

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Pindah tanam

Secara umum, bibit umur lima (di dataran rendah) dan enam (di dataran tinggi) minggu setelah semai, dapat bertahan hidup dengan baik (sekitar 95%) setelah ditanam di lapangan. Sebelum bibit dicabut dari persemaian, disarankan bedengan disiram dahulu dan tanah di sekitar garitan dicongkel dengan pisau atau sekop kecil. Bibit ditanam dengan kedalaman antara 1,5 -2 cm.

Produktivitas

Hasil bawang merah dari TSS lebih tinggi dibanding dari benih umbi biasa. Hasil rata-rata Tuktuk dengan kerapatan 150 tanaman/m² yang ditanam pada percobaan di Brebes pada bulan Mei tahun 2008 dan 2009 adalah 70% lebih tinggi dari hasil Bima Curut. Sedangkan Sanren dengan kerapatan 150 tanaman/m² hasilnya 25% lebih tinggi dari Tuktuk.

Hasil (ton/1600 m²) di percobaan 2008 dan 2009

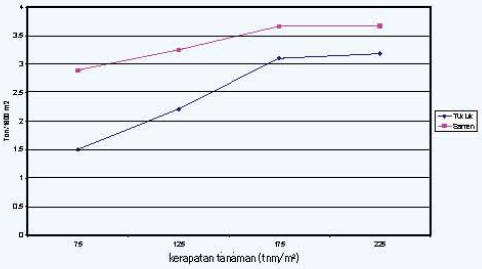
	2008	2009	
	Percobaan kerapatan tanaman	Percobaan kerapatan tanaman*	Percobaan Pupuk N
Tuktuk 150 tnm/m²	5,8	2,7	2,9
Sanren 150 tnm/m²	6,8	3,4	4,1
Bima Curut	2,3	2,2	2,3

* Hasil TSS merupakan rerata dari 125 dan 175 tnm/m²

Kerapatan tanaman

Ada perbedaan antar varietas dalam hal kerapatan tanaman yang optimal. Untuk Tuktuk kerapatannya adalah 150 tanaman/m² sedangkan Sanren adalah 75 tanaman/m². Dengan kerapatan tanaman yang lebih rendah, maka biaya akan lebih rendah karena luas persemaian yang dibutuhkan lebih sempit dan tenaga kerja tanam yang dibutuhkan akan lebih sedikit. Hasil Sanren 75 tnm/m² sama dengan hasil Tuk tuk 150 tnm/m. Hasil Sanren 75 tnm/m² akan meningkat dengan meningkatnya kerapatan menjadi 150 tnm/m², namun peningkatan hasil tersebut kurang menguntungkan karena peningkatan biayanya lebih tinggi dari peningkatan keuntungan yang didapat.

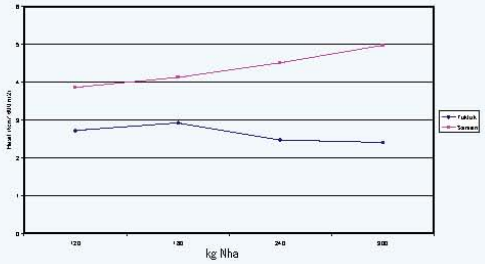
Pengaruh kerapatan tanaman terhadap hasil; hasil (ton per 1600 m²)



Pemupukan Nitrogen

Ada perbedaan antar varietas dalam hal pemupukan nitrogen yang optimal: untuk Tuktuk pemberian pupuk nitrogen lebih tinggi dari 120 kg N/ha tidak meningkatkan hasil, bahkan menurunkan kualitas hasil. Sanren dengan pemupukan 300 kg N/ha hasilnya 29% lebih tinggi dibanding Sanren dengan pemupukan 120 kg N/ha. Peningkatan hasil terjadi, tanpa menurunkan kualitas hasil.

Pengaruh pemupukan nitrogen terhadap hasil; hasil (ton per 1600 m²)



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Appendix 5. Leaflets

Teknik Produksi Bawang Merah Menggunakan Biji Botani

HORTIN II Program Ko-inovasi; July 2010
Ke arah pembentukan rantai pasokan berkualitas tinggi dengan biaya yang efektif

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Teknik Produksi Bawang Merah Menggunakan Biji Botani

Penggunaan biji botani dalam produksi bawang merah (True Shallot Seed = TSS) merupakan alternatif dari penggunaan benih umbi. Proses produksi bawang merah menggunakan TSS terdiri dari 2 (dua) tahap, yaitu: (1) Produksi bibit TSS di persemaian, dan (2) Menumbuhkan bibit TSS di lahan produksi. Berdasarkan hasil penelitian Hortin II dari tahun 2007 - 2009, direkomendasikan teknik produksi bawang merah menggunakan biji botani, sebagai berikut:

Persemaian

Tipe persemaian

Persemaian dapat dilakukan dengan dua cara, yaitu: (1) Di bedengan persemaian di lapangan, dan (2) Di baki yang diisi media persemaian. Penggunaan benih pada persemaian di baki lebih efisien dibanding persemaian di bedengan lapangan. Namun, biaya persemaian dibaki lebih mahal dibanding persemaian di bedengan akibat tingginya biaya pembelian baki dan banyaknya tenaga kerja yang diperlukan.

1. Persemaian di lapangan

Persiapan bedengan

Bedengan disiapkan dengan baik. Pada lahan bekas padi, diperlukan persiapan lahan yang lebih lama untuk mendapatkan bedengan yang baik, dibanding pada lahan bekas tanaman selain padi. Jika tersedia, tambahkan pupuk kandang matang di tanah bedengan (kira-kira 10 kg/m²). Usahakan permukaan tanah bedengan sehalus mungkin. Sebelum semai taburkan 50 gram KCl, 30 gram SP36 dan 5 gram carbofuran, campurkan dengan tanah di permukaan bedengan. Umumnya, pupuk nitrogen tidak dibutuhkan. Namun, jika pertumbuhan jelek, sedikit nitrogen boleh ditambahkan (misalnya: dikocor dengan 2 gr NPK per liter air).

Pengendalian hama tanah sebelum semai

Sehari sebelum semai, ulat tanah, semut, orong-orong dan insek lainnya di bedengan persemaian harus dikendalikan. Semut dapat memakan biji yang disemai, orong-orong, ulat tanah dan insek lainnya dapat merusak bibit yang baru tumbuh. Campuran dedak dengan Dursban (Dedak 5 kg + Dursban 100 cc) dapat digunakan dengan cara ditaburkan di atas permukaan bedengan. Bila perlu, pengendalian ini dilakukan 2-3 kali jika hama tanah masih ada.

Penyemaian

Sebaiknya, benih disemai dalam garitan. Jarak antar garitan 7-10 cm. Garitan dapat dibuat menggunakan batang bambu, dan kedalaman garitan antara 1 - 1,5 cm. Tanah di garitan harus cukup basah agar benih dapat berkecambah. Kedalaman semai sangat menentukan keberhasilan, kedalaman semai yang optimal adalah 1 cm. Setelah benih disemai, garitan ditutup dengan tanah. Pastikan bahwa benih yang disemai benar-benar tertutup tanah. Setelah ditutup tanah, bedengan disiram. Jumlah benih yang disemai sekitar 3000 benih per m2 atau 9 gram per m². Agar mudah dilakukan dan dilihat apakah benih sudah disebar merata di garitan dengan kedalaman 1 cm, benih dapat dicampur dengan beras menir dengan perbandingan 1:1, atau dicampur dengan bahan lain seperti fungisida yang berwarna putih atau lainnya. Dengan efisiensi benih 40%, dapat dihasilkan 1200 bibit TSS per m². Untuk luas pertanaman 1600 m² dengan jarak tanam 10 x 10 cm atau 100 tanaman per m² dibutuhkan lahan persemaian sekitar 93 m².

Tutup persemaian

Setelah garitan ditutup tanah dan disiram, bedengan persemaian perlu ditutup dengan plastik atau jerami padi setebal 5 cm, agar persemaian tetap lembab. Tutup persemaian harus dibuka sekitar 3 hari ketika benih sudah berkecambah secara merata. Jangan terlambat membuka tutup persemaian, karena dapat merusak bibit yang baru berkecambah.

Naungan

Jika diperkirakan akan terjadi hujan atau panas yang terlalu terik, disarankan untuk memasang naungan di atas bedengan. Naungan dibuat dengan menggunakan rangka bambu dan plastik kasa, untuk daerah yang banyak angin, atau plastik transparan biasa untuk daerah yang kurang angin.

Penyiraman

Setelah benih berkecambah, penyiraman harus dilakukan secara intensif (2-3 kali sehari) dan hati-hati menggunakan emrat atau gembor. Perhatian perlu dilakukan agar persemaian tidak terlalu kering atau terlalu lembab.

Pengendalian hama dan penyakit

Persemaian perlu sering di kontrol. Pengendalian perlu dilakukan terhadap serangan orong-orong (dengan campuran dedak 5 kg + 100 cc Dursban), ulat bawang Spodoptera sp. (dengan Traser) atau penyakit otomatis/anthracnose (dengan Amistar Top).

Panen bibit di persemaian

Bibit dapat dipanen pada umur 5 minggu di dataran rendah, dan 6 minggu di dataran tinggi. Bibit tersebut mempunyai 2-3 daun. Sebelum bibit di panen, perlu dilakukan penyiraman, dan sebelum bibit dicabut, tanah didekat garitan perlu digali terlebih dahulu dengan pisau atau alat lain. Dengan cara ini, bibit mudah dicabut dan tetap segar untuk waktu yang lebih lama. Sebaiknya bibit ditanam di lapangan 3-4 jam setelah dipanen.

2. Persemaian menggunakan baki (jika diinginkan)

Baki diisi dengan media persemaian yang terdiri dari campuran tanah berpasir dan pupuk kandang atau kompos. Hasil terbaik diperoleh jika 1/3 atau 1/2 media merupakan pupuk kandang. Tanah sawah tidak cocok untuk media persemaian. Penyemaian dan pemeliharaan dilakukan dengan cara yang sama dengan penyemaian di bedengan. Agar tidak mengalami stress kekeringan, baki diletakkan di atas tanah.

Produksi di lapangan

Tanah di bedengan disiapkan agar tanaman dari TSS tumbuh optimal, dengan pH tanah berkisar antara 5,5 - 6,0. Jika pH di bawah 5,5 tambahkan kapur dengan dosis 2500 kg CaCO3 per ha. Pada tanah normal, perlu diberikan 125 kg P2O5 per ha, 1-2 hari sebelum pindah tanam. Jika tersedia, perlu ditambahkan pupuk kandang. Permukaan bedengan harus datar dan struktur tanahnya cukup halus sehingga bibit TSS dapat ditanam dengan kedalaman yang sesuai. Sebelum tanam, perlu dilakukan penyiraman bedengan.

Penanaman bibit

Penanaman dilakukan pada garitan dengan jarak garitan 10 - 15 cm. Kerapatan tanaman tergantung pada varietas yang ditanam. Untuk varietas Tuktuk 150 tanaman per m2 (atau jarak tanam 10 cm x 7 cm), dan untuk varietas Sanren 75 tanaman per m2 (atau jarak tanam 15 cm x 9 cm). Bibit ditanam dengan kedalaman antara 1,5 - 2,0 cm. Tanah disekitar bibit yang ditanam, sedikit ditekan.

Penyiraman

Pada awal 3 minggu setelah tanam, penyiraman dilakukan secara hati-hati menggunakan emrat atau gembor, sedikitnya 2 kali sehari. Setelah itu, penyiraman dapat dilakukan menggunakan alat siram yang biasa digunakan setempat.

Pemupukan

Dosis optimal pupuk nitrogen yang diberikan berbeda-beda antar varietas. Untuk Tuktuk direkomendasikan 120 kg pupuk N per ha (13,4 kg N per 1600 m²), sedangkan untuk Sanren 160-180 kg pupuk N per ha (17,9 - 20,2 kg N per 1600 m²). Terlalu banyak nitrogen berpengaruh negatif terhadap umbi hasil panen, khususnya untuk Tuktuk. Nitrogen sebaiknya diberikan sebanyak 3 kali, 2 minggu, 4 minggu, dan 6 minggu setelah tanam. Setiap kali pemberian adalah 1/3 dosis rekomendasi. Pupuk nitrogen dapat diberikan dalam bentuk NPK, Urea, atau ZA. Selain pupuk nitrogen, direkomendasikan untuk memberikan 100 kg KCl/ha (11,2 kg KCl/1600 m²) pada 4 minggu dan 6 minggu setelah tanam.

Pengendalian hama dan penyakit

Pada musim kemarau, hama perlu dikendalikan dengan intensif. Khususnya ulat bawang Spodoptera sp. Disamping itu, thrips dan liriomyza juga perlu diperhatikan. Insektisida yang selektif dan efektif dapat digunakan, seperti Traser dan Hostathion untuk ulat bawang. Pada musim hujan, penyakit yang perlu dikendalikan, antara lain penyakit otomatis (Anthracnose), trotol (Alternaria porii), dan Peronospora destructor. Fungisida yang sesuai dapat digunakan, seperti Amistar Top dan Score.

Panen

TSS dapat dipanen pada saat 75% dari daunnya telah rebah, yaitu saat tanaman berumur 70-80 hari tergantung dari varietas yang ditanam. Sanren umur panennya lebih genjah dibanding Tuktuk. Tanaman dicabut hati-hati, dibersihkan dan diikat. Penjemuran dilapangan dilakukan selama sekitar 7 hari.

Hasil

Hasil umbi dari TSS lebih tinggi dari hasil benih umbi. Dengan menggunakan TSS, hasil rata-rata Tuktuk yang ditanam pada

bulan Mei 2008 dan 2009 dengan kerapatan 150 tanaman/m², 70% lebih tinggi dibandingkan dengan hasil umbi Bima Curut yang menggunakan benih umbi. Sedangkan Sanren, dengan menggunakan TSS dan ditanam 150 tanaman/m², hasilnya 25% lebih tinggi dibandingkan dengan Tuktuk.

Analisis usahatani

Perhitungan biaya usahani pada tabel dibawah ini menunjukkan perbandingan biaya usahatani bawang merah menggunakan TSS dan benih umbi. Perhitungan dilakukan berdasarkan asumsi bahwa persemaian dilakukan di bedengan lapangan, efisiensi benih sebesar 40%, dan kerapatan tanaman di lapangan adalah 150 tanaman per m².

Perbandingan biaya berubah usahatani bawang merah menggunakan TSS dan benih umbi untuk 1600 m²

URAIAN		BIAYA BERUBAH (x Rp 10.000)	
		TSS	BENIH UMBI
Persemaian/beli benih umbi			
Benih umbi (Rp. 15.000,-/kg, 326 kg)			489
Benih TSS*** (Rp. 1200,- IDR/gr, 1,26 kg)		151	
Pupuk kandang (280 kg)		17	
Tenaga kerja*:			
	Pengolahan lahan	39	
	Penyemaian	11	
	Pembuatan naungan	34	
	Penyiraman/penyiangan/pemupukan/penyemprotan	22	
Bahan			
	Naungan	49	
	Pestisida	11	
	Pupuk	3	
Produksi di lapangan			
Tenaga kerja*:			
	Pindah tanam	60	10
	Penyiraman/penyiangan/pemupukan/penyemprotan	167	121
	Panen dan penjemuran	56	56
Pupuk kandang		64	64
Insektisida		324	257
Fungisida		50	40
Total biaya berubah		1048	1027
Hasil**		1916	1126

* Upah Tenaga Kerja Pria Rp. 25.000,-; Wanita Rp. 13000,-

** Berdasarkan hasil rata-rata Tuktuk, 2008/2009: 3830 kg, @ Rp. 5000,-/kg
Benih umbi, 2008/2009: 2250 kg, @ Rp. 5000,-/kg

*** Persemaian 140 m²; 3000 benih/m²; Efisiensi benih 40%; Kerapatan tanaman 150 tanaman/m²

Catatan: Perhitungan ini merupakan contoh. Jika kondisi berubah, maka harus dibuat perhitungan baru (harga benih, harga jual bawang, efisiensi benih)

PPO dan Balitsa tidak bertanggung jawab atas kerugian yang mungkin terjadi sebagai akibat penggunaan informasi ini.

Appendix 6. Costs of nursery in Brebes

Area nursery (m2)	neto	=	80 m2
	bruto	=	114 m2

	IDR
I. Cost of labour	
1. Land preparation 5.7 men @ 30000	171,000
2. Application of fertilizer, manure, CaCO3, rice husk, 2 men @ 30000	60,000
3. Rowing beds, 1 man @ 30000	30,000
4. Making shading, 2 men @ 30,000	60,000
5. Sowing seed 2 women @ 20,000	40,000
6. Covering seed 2 women @ 20,000	40,000
7. Covering and un-covering rice straw for nursery cover	20,000
8. Watering : 4 to 7 days after sowing @ 20,000	80,000
9. Watering : 7 to 40 days after sowing @ 10,000	300,000
10. Spraying: 3 x during nursery	50,000
11. Weeding	90,000
Total labour cost	**941,000**
II. Cost of material	
1. True seed	
a. Sanren 400 gr , 2 million per kg	800,000
b. Tuk Tuk 400 gr, 1.2 million per kg	480,000
2. Fertilizer:	
a. SP 36 50 gr/m2 @ 3000/kg	12,000
b. KCl 50 gr/m2 @ 3000/kg	12,000
3. Pesticides:	
a. Furadan 5 gr @ 10,000	4,000
b. Dursban 100 cc: 3x @ 7000	21,000
c. "Dedak" 10 kg: 3 x @ 10000	30,000
d. Amistartop (4 tanks @ 15 cc = 60 cc)	35,000
e. Daconil (3 Tanks @ 15 gr = 45 cc) @ 17,000/100 gr	7,650
f. Demolish (3 Tanks @ 10 cc = 30 cc) @ 60,000/100 cc	18,000
g. Decis (4 Tanks @ 20 ml = 80 ml) @ 18,000/80 ml	18,000
4. Bamboo 10 stems @ 7,000 = 70,000 (can be used for 2 times) : 70,000/2	35,000
5. Plastic 12 kg (80 meter) @ 20,000 = 240,000 (can be used for 2 times) : 240,000/2	120,000
III. Other costs	
1. Land rent (2 month: land preparation + seedlings age))	**25,000**
Total material cost	**1,617,650**
Total nursery cost	**2,558,650**
Total nursery cost - cost of TSS	**1,278,650**
Cost of nursery per kg seed (excluding TSS cost)	**1,598,313**

Appendix 7. Cost of nursery in Nganjuk1

Nganjuk1			
Area nursery (m2)	=	84	
I. Cost of labour			IDR
1. Land preparation, 10 men @ 40000			400,000
2. Application of fertilizer, manure, CaCO3, rice husk			
3. Rowing beds			
4. Making shading, 2 men @ 40,000			80000
5. Sowing seed 1 man @40,000			40000
6. Covering seed 0.5 man @ 20,000			20000
7. Covering and un-covering rice straw for nursery cover			
8. Watering : 2 to 15 d.a.s, twice a day,28x @ 1.5 hours			210000
9. Watering : 16 to 42 d.a.s., once a day, 26 x @ 1 hour			130000
10. Spraying: 15-42 d.a.s; every 3 days; 9x			11250
11. Weeding: 2x women @ 32500			65000
Total labour cost			**956,250**
II. Cost of material			
1. True seed			
a. Sanren 700 gr			1,400,000
b. Tuk Tuk 600 gr			720,000
2. Fertilizer:			
a. Saprodap: 20 kg @ 3000			60,000
b. Compost 400 kg @ 400			160,000
c. Lime 400 kg @ 400			160,000
3. Pesticides:			
a. Furadan 2 kg @ 9000			18,000
b. Ridomil 0.09 kg @ 248000			22,320
c. Cabrio 0.015 kg @ 650000			9,750
d. Daconil 0.06 kg @190000			11,400
4. Bamboo 15 stems @ 15,000 = 225000 (used for twice)			112,500
5. Plastic 4.5 rolls @ 100,000 = 450000 (used for twice)			225,000
6. Black plastic mulch 3 rolls @ 18000			54,000
7. Rope 1 roll @ 20000			20,000
Total material cost			**2,972,970**
Total nursery cost			**3,929,220**
Total nursery cost - cost of true seed			**1,809,220**
Cost of nursery per kg seed (excluding TSS cost)			**1,391,708**

Appendix 8. Cost of nursery in Nganjuk2

Nganjuk2		
Area nursery (m2) = 130 m2		
I. Cost of labour		IDR
1. Land preparation		240,000
2. Application of fertilizer, manure, CaCO3, rice husk, 0.13 man		5200
3. Rowing beds		
4. Making shading, 5 men @ 40,000		200000
5. Sowing seed 1 man @40,000		40000
6. Covering seed 1 man @ 40,000		40000
7. Covering and un-covering rice straw for nursery cover		
8. Watering : 0 to 7 d.a.s, twice a day, @ 1.5 hours		105000
9. Watering : 8 to 36 d.a.s., once a day, @ 1 hour (3.5 men)		140000
10. Spraying: 15-42 d.a.s; every 3 days; **9x**		90000
11. Weeding: 1 man, 4 women		160000
Total labour cost		**1,020,200**
II. Cost of material		
1. True seed		
a. Sanren 700 gr		1,400,000
b. Tuk Tuk 600 gr		720,000
2. Fertilizer:		
a. Saprodap: 4kg @ 5500		22,000
b. KCl 2 kg @ 6000		12,000
c. NPK 2 kg @ 7500		15,000
d. Compost 150 kg @ 1000		150,000
3. Pesticides:		
a. Marshall 0.04 l @ 92000		3,680
b. Agrimec 0.044 l @ 1050000		46,200
c. Kiliri 0.044 l @ 850000		37,400
d. Prevathon 0.179 l @ 540000		96,660
e. Cabrio 0.13 kg @ 650000		84,500
f. Amistar 0.0125 @ 540000		6,750
g. Benlete 0.06 kg @ 196000		11,760
4. Bamboo 15 stems @ 15,000 (to be used for twice)	286,950	56250
5. Plastic 4 rolls @ 75,000 (to be used for twice)		75000
6. Black plastic mulch 5 rolls @ 7500		37,500
7. Rope 15 roll @ 12000		180,000
Total material cost		**2,954,700**
Total nursery cost		**3,974,900**
Total nursery cost - true seed		**1,854,900**
Cost of nursery per kg seed (excluding TSS cost)		**1,426,846**

Appendix 9. Cost of growing shallot from TSS in the field in *Brebes*

Plant spacing : 6.7 x 10 cm (150 plant/m2)

Cost of growing TSS in the field	**Per 306 m2**			**Per 1600m2**
	Unit	Price	Value (IDR)	Value (IDR)
I. Labour				
1. Land preparation (Man):	14.4	30000	432,000	2258824
2. Transplanting				
- TSS Women	6.8	18000	123,000	643137
- men	1	30000	30,000	156863
3. Weeding (10x @2 wowen)	20	18000	360,000	1882353
4. Watering	5.3	30000	160,000	836601
5. Spraying 1.5 tanks @ 5000 = 7,500 (20 times)	5	30000	150,000	784314
6 Fortifying beds 3 men @ 30,000	3	30000	90,000	470588
7. Fertilizing 4 women @ 7,500	1.7	18000	30,000	156863
8. Harvesting : 3 women @ 18,000	3		54,000	282353
Cost of labour			**997,000**	**7,471,895**
II. Materials				
1. Fertilizer:				
a. SP 36 : 7,5 kg @ 3000	7.5	3000	22,500	117647
b. NPK Mutiara 23,4 kg @ 7000	23.4	7000	163,800	856471
c. KCl Canada 2,7 kg @ 7000	2.7	7000	18,900	98824
2. Pesticides:				0
a. Furadan 2 kg @ 10,000	2	10000	20,000	104575
b. Demolish (3 tank @ 10 ml = 30 ml)@ 60,000/100 ml	0.03	600000	18,000	94118
c. Decis (3 tangki @ 20 ml = 60 ml) @ 12,000/60 ml	0.06	200000	12,000	62745
d. Prevaton (6 tanks @ 20 cc = 120 cc) @ 120,000/100 cc	0.12	1200000	144,000	752941
e. Amistartop (12 tanks @ 15 cc = 180 cc) @ 65,000/100 ml	0.18	650000	117,000	611765
f. Dursban (200 ml @ 70,000/1000 ml)	0.2	70000	14,000	73203
g. Rice sifting 10 kg @ 2000	10	2000	20,000	104575
Total material costs			**550,200**	**2876863**
III Other costs				
- Land rent (4 months)	0.031	4000000	122,400	700000
Total costs			**1,669,600**	**11,048,758**

Appendix 10. Cost of growing shallot from TSS in the field in Nganjuk1

Plant spacing : 6.7 x 10 cm (150 plant/m2)

	Per 294.4 m2			**Per 1750 m2**
I. Labour	Unit	Price	Value (IDR)	Value (IDR)
1. Land preparation (Man)	12	40000	480000	2857143
2. Tanam: TSS and bulb	8.6	32500	279500	1663690
3. Weeding TSS (no weeding for bulb seed)	2	32500	65000	386905
4. Watering (10 times @ 30 minutes)	0.6	40000	24000	142857
5. Spraying (27 times @ 20 minutes)	1.1	40000	44000	261905
6. Fortifying beds (ikut Puji)	1.8	40000	72000	428571
7. Fertilizing (5 times @ 1 jam)	0.6	40000	24000	142857
8. Harvesting:	2	40000	80000	476190
Cost of labour			**1068500**	**6360119**
II. Materials				
1. Fertilizer:				
a. SP 36 : 7,5 kg @ 3000	10	6000	60000	357143
b. NPK Mutiara 23,4 kg @ 7000	0.6	7500	4500	26786
c. KCl Canada 2,7 kg @ 7000	13.8	7500	103500	616071
d. ZA	2	6000	12000	71429
3. Pestisida				
a. Ridomil	0.18	360000	64800	385714
b. Daconil	0.1	190000	19000	113095
c. Cabrio	0.048	650000	31200	185714
d. Amistar	0.2	580000	116000	690476
e. Trivia	0.22	290000	63800	379762
f. Equation	0.06	770000	46200	275000
g. Kiliri	0.0945	920000	86940	517500
h. Lanate	0.04	180000	7200	42857
Total material costs			**615140**	**3661548**
III Other cost				
- Land rent (4 months)	0.0294	10000000	**294000**	**1750000**
Total costs			**1977640**	**11771667**

Appendix 11. Cost of growing shallot from TSS in the field in Nganjuk2

Plant spacing : 6.7 x 10 cm (150 plant/m2)

	Per 478 m2			**Per 1750 m2**
I. Labour	**Unit**	Price	Value (IDR)	Value (IDR)
1. Land preparation	19	40000	768000	2811715
2. Transplanting: TSS and seed bulb	10	32500	331250	1212735
3. Watering	13	40000	520000	1903766
4. Penyemprotan	2	40000	68333	250174
5. Menyiang 3 kali (1 - 11)	3	32500	97500	356956
6. Dangir 1 kali (1 - 11)	1	40000	40000	146444
7. Temok 1 kali (1 - 11)			72500	265429
- men	1	40000	40000	146444
- women	1	32500	32500	118985
8. pasang ppk susulan 7 KALI	4	40000	155000	567469
9. Panen				
- men	4	30000	120000	439331
- women	2	50000	100000	366109
Total labour cost			**2345083**	**8585556**
II. Materials	KG/L	HARGA	NILAI(RP)	
2. Pupuk : (1 - 11)				
a. SP-36	13	3000	37674	137928
b. KCl	4	6000	26910	98520
c. NPK	35	7500	260550	953896
3. Pestisida :				
a. amistar	0.16	650000	104000	380753
b. Ridomil	0.10	360000	36000	131799
c. Daconil	0.10	190000	19000	69561
e. Equation	0.04	700000	28000	102510
f. cabrio	0.08	650000	52000	190377
g. trivia	0.10	240000	24000	87866
a. asmec	0.11	1000000	110000	402720
b. marsal	0.64	92000	58880	215565
c. prepaton	0.16	496000	79360	290544
a. borer	0.22	160000	35200	128870
Total material costs			**871574**	**3190909**
III Other costs				
- Land rent (4 months)	0.0480	4000000	192000	**702929**
Total costs			**3408657**	**12479394**

Appendix 12. Farmers' scores on the characteristics of crops in the demplot in Brebes

Plots number	Treatments	The crop growth	Pest and deseases resistance	Crop character (CC)	Tuber size	Tuber colour	Market acceptance	Tuber caharacter (TC)	Total characters (TT)
1	Tuktuk 6,7 x 10 cm + 240 kg N/ha	3.1	2.7	5.8	3.5	3	3.1	9.6	15.4
2	Tuktuk 13,3 x 10 cm + 240 kg N/ha	3	2.8	5.8	2.7	2.6	2.8	8.1	13.9
3	Tuktuk 6,7 x 10 cm + 120 kg N/ha	2.5	2.5	5	3.1	3	3.1	9.2	14.2
4	Sanren 13,3 x 10 cm + 120 kg N/ha	2.6	2.5	5.1	3	3	3	9	14.1
5	Sanren 13,3 x 10 cm +240 kg N/ha	2.9	2.6	5.5	2.8	2.9	3.2	8.9	14.4
6	Sanren 6,7 x 10 cm + 120 kg N/ha	2.9	2.8	5.7	3.5	3.3	3.4	10.2	15.9
7	Sanren 6,7 x 10 cm + 240 Kg N/ha	3.3	3	**6.3**	3.6	3.3	3.4	**10.3**	**16.6**
8	Direct seeding Sanren + 120 kg N/ha	-	-		-	-	-	-	-
9	Sanren 16 x 10 cm + 120 kg N/ha	3.4	3	**6.4**	3.4	3.3	3.3	**10**	**16.4**
10	Local tuberseed + 120 kg N/ha	3.7	3.4	**7.1**	2.7	3.2	3.1	**9**	**16.1**
11	Sanren tuber seed (F2) + 120 kg N/ha	-	-		-	-	-		-

Appendix 13. Farmers' scores on the characteristics of crops in the demplot in Nganjuk1

Plots number	Treatments	The crop growth	Pest and deseases resistance	Crop character (CC)	Tuber size	Tuber colour	Market acceptance	Tuber caharacter (TC)	Total characters (TT)
1	Tuktuk 6,7 x 10 cm + 240 kg N/ha	3.3	2.8	6.1	3.5	3.4	3.1	10	16.1
2	Tuktuk 13,3 x 10 cm + 240 kg N/ha	3.5	3.3	6.8	3.6	3.3	3.1	10	16.8
3	Tuktuk 6,7 x 10 cm + 120 kg N/ha	3.6	3	6.6	3.7	3.9	3.6	11.2	17.8
4	Sanren 13,3 x 10 cm + 120 kg N/ha	3.7	3.1	6.8	3.7	3.9	3.9	11.5	18.3
5	Sanren 13,3 x 10 cm +240 kg N/ha	3.6	3.2	6.8	3.8	3.7	3.6	11.1	17.9
6	Sanren 6,7 x 10 cm + 120 kg N/ha	3.5	3.4	6.9	3.9	3.9	4	11.8	18.7
7	Sanren 6,7 x 10 cm + 240 Kg N/ha	4.3	3.8	**8.1**	4.2	4.1	4.1	**12.4**	20.5
8	Direct seeding Sanren + 120 kg N/ha	0	0	0	0	0	0	0	0
8	Sanren 16 x 10 cm + 120 kg N/ha	-	-		-	-	-		
9	Local tuberseed + 120 kg N/ha	**3**	**2.7**	**5.7**	**2.2**	**2.4**	**2.5**	**7.1**	12.8
10	Sanren tuber seed (F2) + 120 kg N/ha	3.6	2.9	6.5	4.1	4.1	4	12.2	18.7
11	Sanren tuber seed (F2) + 120 kg N/ha	-	-		-	-	-		-

Appendix 14. Farmers' scores on the characteristics of crops in the demplot in Nganjuk2

Plots number	Treatments	The crop growth	Pest and deseases resistance	Crop character (CC)	Tuber size	Tuber colour	Market acceptance	Tuber caharacter (TC)	Total characters (TT)
1	Tuktuk 6,7 x 10 cm + 240 kg N/ha	4.1	3.7	7.8	4.3	4.1	3.2	11.6	19.4
2	Tuktuk 13,3 x 10 cm + 240 kg N/ha	3.7	3.3	7	4.3	4.1	3.2	11.6	18.6
3	Tuktuk 6,7 x 10 cm + 120 kg N/ha	3.7	3.3	7	4.3	4.1	3.2	11.6	18.6
4	Sanren 13,3 x 10 cm + 120 kg N/ha	3.9	3.8	7.7	4.5	4.1	3.7	12.3	19.9
5	Sanren 13,3 x 10 cm +240 kg N/ha	4.1	3.9	8	4.5	4.1	3.7	12.3	20.3
6	Sanren 6,7 x 10 cm + 120 kg N/ha	**4.3**	**4.1**	8.4	**4.5**	**4.1**	**3.7**	12.3	**20.6**
7	Sanren 6,7 x 10 cm + 240 Kg N/ha	**4.7**	**4.3**	9	**4.5**	**4.1**	**3.7**	12.3	**21.2**
8	Direct seeding Sanren + 120 kg N/ha	3.3	3.3	6.6	4.5	4.1	3.7	12.3	18.9
9	Sanren 16 x 10 cm + 120 kg N/ha	-	-		-	-	-		-
10	Local tuberseed + 120 kg N/ha	**3.3**	**2.9**	6.2	**3**	**3.1**	**3.5**	**9.6**	**15.9**
11	Sanren tuber seed (F2) + 120 kg N/ha	3.9	3.4	7.3	4.5	4.1	3.7	12.3	19.5

Appendix 15. Farmers evaluation on characteristics of the crop performance (CP) and tuber quality (TQ) of crops in the demplot

Plots number	Treatments	Brebes		Nganjuk1		Nganjuk2	
		CC Score	TC Score	CC Score	TC Score	CC Score	TC Score
1	Tuktuk 6,7 x 10 cm + 240 kg N/ha	5.8	9.6	6.1	10.0	7.8	11.6
2	Tuktuk 13,3 x 10 cm + 240 kg N/ha	5.8	8.1	6.8	10.0	7.0	11.6
3	Tuktuk 6,7 x 10 cm + 120 kg N/ha	5.0	9.2	6.6	11.2	7.0	11.6
4	Sanren 13,3 x 10 cm + 120 kg N/ha	5.1	9.0	6.8	11.5	7.7	12.3
5	Sanren 13,3 x 10 cm +240 kg N/ha	5.5	8.9	6.8	11.1	8.0	12.3
6	Sanren 6,7 x 10 cm + 120 kg N/ha	5.7	10.2	6.9	11.8	8.4	12.3
7	Sanren 6,7 x 10 cm + 240 Kg N/ha	**6.3**	**10.3**	**8.1**	**12.4**	**9.0**	**12.3**
8	Direct seeding Sanren + 120 kg N/ha	-	-	0	0	6.6	12.3
9	Sanren 16 x 10 cm + 120 kg N/ha	6.4	10	-	-	-	-
10	Local seed + 120 kg N/ha	**7.1**	**9**	**5.7**	**7.1**	**6.2**	**9.6**
11	Sanren tuber seed (F2) + 120 kg N/ha	-	-	6.5	12.2	7.3	12.3

Notes:

CC categories	Scores	TC categories	Scores
very bad	1.8 - 3.4	very bad	2.8 - 5.2
bad	3.5 - 5.1	bad	5.3 - 7.7
medium	5.2 - 6.8	medium	7.8 - 10.2
good	6.9 - 8.5	good	10.3 - 12.7
very good	8.6 - 10.2	very good	12.8- 15.2

Appendix 16. Farmers choice of the most preferred sowing techniques in Brebes (n=23)

	Sowing techniques	Shading on nursery			
		No shading		Shading	
		Freq	%	Freq	%
A	In rows, 1 cm depth, covered with soil	6	26	8	35
B	In rows, 0.25 cm depth, covered with soil	0	0	2	9
C	In rows, 1 cm depth, covered with fermented rice husk	0	0	2	9
D	In rows, 1 cm depth, covered with fermented rice husk	0	0	3	13
E	Broadcasted	1	4	0	0
F	In trays, media: soil:sand: manure (1:1:1)	0	0	0	0
G	In trays, media: soil:sand: manure (1:1:1)	0	0	0	0
	No response	1	4	0	0

Appendix 17. Farmers choice of the most preferred sowing techniques in Nganjuk1

Farmers choice of the most preferred sowing techniques in Nganjuk1 (n=14)

	Sowing techniques	Shading on nursery			
		No shading		Shading	
		Freq	%	Freq	%
A	In rows, 1 cm depth, covered with soil	1	7	11	79
B	In rows, 0.25 cm depth, covered with soil	1	7	0	0
C	In rows, 1 cm depth, covered with fermented rice husk	0	0	0	0
D	In rows, 1 cm depth, covered with fermented rice husk	0	0	0	0
E	Broadcasted	0	0	0	0
F	In trays, media: soil:sand: manure (1:1:1)	1	7	0	0
G	In trays, media: soil:sand: manure (1:1:1)	0	0	0	0
	No response	0	0	0	0

Appendix 18. Farmers choice of the most preferred sowing techniques in Nganjuk2

Farmers choice of the most preferred sowing techniques in demplot (n=15)

	Sowing techniques	Shading on nursery			
		No shading		Shading	
		Freq	%	Freq	%
A	In rows, 1 cm depth, covered with soil	5	33	8	53
B	In rows, 0.25 cm depth, covered with soil		0	1	7
C	In rows, 1 cm depth, covered with fermented rice husk		0		0
D	In rows, 1 cm depth, covered with fermented rice husk	1	7		0
E	Broadcasted		0		0
F	In trays, media: soil:sand: manure (1:1:1)		0		0
G	In trays, media: soil:sand: manure (1:1:1)		0		0
	No response		0		0

Appendix 19. Farmers' preferences on techniques of TSS in production field in Brebes

Farmers' preferences on the performance of the crops in demplot, Brebes.

		Frequency n=23	%	Total score
1	Tuktuk 6,7 x 10 cm + 240 kg N/ha	1	4	3
2	Tuktuk 13,3 x 10 cm + 240 kg N/ha	0	0	0
3	Tuktuk 6,7 x 10 cm + 120 kg N/ha	3	13	7
4	Sanren 13,3 x 10 cm + 120 kg N/ha	1	4	3
5	Sanren 13,3 x 10 cm +240 kg N/ha	3	13	7
6	Sanren 6,7 x 10 cm + 120 kg N/ha	10	**43**	**23**
7	Sanren 6,7 x 10 cm + 240 Kg N/ha	20	**87**	**40**
8	Direct seeding Sanren + 120 kg N/ha	-	-	-
8	Sanren 16 x 10 cm + 120 kg N/ha	20	**87**	**34**
9	Local tuberseed (k cm x l cm)**) + 120 kg N/ha	11	48	21
10	No.10 (F2) + 120 kg N/ha			
11	No.11 (F2) + 120 kg N/ha			

Appendix 20. Farmers' preferences on techniques of TSS in production field in Nganjuk1

Farmers' preferences on the performance of the crops in demplot, in Nganjuk1

		Frequency n=14	%	Total score
1	Tuktuk 6,7 x 10 cm + 240 kg N/ha	1	7	1
2	Tuktuk 13,3 x 10 cm + 240 kg N/ha	0	0	0
3	Tuktuk 6,7 x 10 cm + 120 kg N/ha	4	29	9
4	Sanren 13,3 x 10 cm + 120 kg N/ha	8	57	**17**
5	Sanren 13,3 x 10 cm +240 kg N/ha	3	21	7
6	Sanren 6,7 x 10 cm + 120 kg N/ha	3	21	7
7	Sanren 6,7 x 10 cm + 240 Kg N/ha	8	57	**12**
8	Direct seeding Sanren + 120 kg N/ha	0	0	0
8	Sanren 16 x 10 cm + 120 kg N/ha	-	-	-
9	Local tuberseed (k cm x l cm)**) + 120 kg N/ha	0	0	0
10	No.10 (F2) + 120 kg N/ha	9	64	**19**
11	No.11 (F2) + 120 kg N/ha	-	-	-

Appendix 21. Farmers' preferences on techniques of TSS in production field in Nganjuk1

Farmers' preferences on the performance of the crops in demplot, in Nganjuk2

		Frequency n=15	%	Total score
1	Tuktuk 6,7 x 10 cm + 240 kg N/ha	3	20	7
2	Tuktuk 13,3 x 10 cm + 240 kg N/ha	1	7	3
3	Tuktuk 6,7 x 10 cm + 120 kg N/ha	3	20	7
4	Sanren 13,3 x 10 cm + 120 kg N/ha	3	20	8
5	Sanren 13,3 x 10 cm +240 kg N/ha	6	40	**12**
6	Sanren 6,7 x 10 cm + 120 kg N/ha	10	67	**20**
7	Sanren 6,7 x 10 cm + 240 Kg N/ha	13	87	**19**
8	Direct seeding Sanren + 120 kg N/ha	1	7	3
8	Sanren 16 x 10 cm + 120 kg N/ha	-	-	-
9	Local tuberseed (k cm x l cm)**) + 120 kg N/ha	0	0	0
10	No.10 (F2) + 120 kg N/ha	1	7	1
11	No.11 (F2) + 120 kg N/ha	4	27	10