HORTIN II Co Innovation Programme

Towards cost effective, high quality value chains

Improvement of shallot supply chains; Research 2007

HORTIN-II Research Report nr. 3

Lubbert van den Brink and Rofik Sinung Basuki

Lelystad, The Netherlands, Lembang Indonesia, December 2008

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.

Addresses:

Indonesian Centre for Horticultural Research and Development (ICHORD)
Address : Jl. Ragunan 29A, Pasarminggu, Jakarta 12520, Indonesia
Tel. : +62 21 7890990
Fax : +62 21 7805135
E-mail : pushor@rad.net.id or pushorti@yahoo.com
Internet : www.litbanghortikultura.go.id

Indonesian Vegetable Research Institute (IVEGRI)
Address : Jl. Tangkuban Perahu 517, Lembang-Bandung 40391, West Java, Indonesia
Tel. : +62 22 2786 245
Fax : +62 22 2786 416
E-mail : dir_ivegri@balits.org or balitsa@balitsa.org
Internet : www.balitsa.org

Indonesian Centre for Agricultural Postharvest Research and Development (ICAPRD)
Address : Kampus Penelitian Pertanian, Cimanggu, Bogor 16114, West Java, Indonesia
Tel. : + 62 251 321762
Fax : + 62 251 350920
E-mail : bb_pascapanen@litbang.deptan.go.id or bb_pascapanen@yahoo.com
Internet : www.pascapanen.litbang.deptan.go.id

Agricultural Economics Research Institute (AEI)
Address : Alexanderveld 5, Den Haag, The Netherlands
: PO Box 29703, 2502 LS Den Haag, The Netherlands
Tel. : +31 70 335 83 30
Fax : +31 70 361 56 24
E-mail : informatie.lei@wur.nl
Internet : www.lei.wur.nl

Agrotechnology and Food Sciences Group (ASFG)
Address : Building 118, Bornsesteeg 59, Wageningen, The Netherlands
: PO Box 17, 6700 AA, Wageningen, The Netherlands
Tel. : +31 317 480 084
Fax : +31 317 483 011
E-mail : info.asfg@wur.nl
Internet : www.asfg.wur.nl

Applied Plant Research (APR)
AGV Research Unit
Address : Edelhertweg 1, Lelystad, The Netherlands
: PO Box 430, 8200 AK Lelystad, The Netherlands
Tel. : +31 320 29 11 11
Fax : +31 320 23 04 79
E-mail : infoagv.ppo@wur.nl
Internet : www.ppo.wur.nl

WUR-Greenhouse Horticulture (WUR-GH)
Address : Violierenweg 1, Bleiswijk, The Netherlands
: PO Box 20, 2665 ZG Bleiswijk, The Netherlands
Tel. : +31 317 48 56 06
Fax : +31 10 52 25 193
E-mail : glastuinbouw@wur.nl
Internet : www.glastuinbouw.wur.nl

© 2008 Applied Plant Research (Praktijkonderzoek Plant & Omgeving BV)/ Arable farming and field production of vegetables, Lelystad, The Netherlands; IVEGRI, Lembang, Indonesia.
All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of Applied Plant Research, Lelystad, The Netherlands; IVEGRI, Lembang, Indonesia.
Applied Plant research, Lelystad, The Netherlands and IVEGRI, Lembang, Indonesia, take no responsibility for any injury or damage sustained by using data from this publication.

Programme Team

	Indonesia	The Netherlands
Programme management	Dr Yusdar Hilman, Director ICHORD Telephone +62 Fax +62 E-mail: Dr.Nikardi Gunadi, IVEGRI Telephone +62 22 2786 245 Fax +62 22 2786 416 E-mail: NGUNADI@BDG.CENTRIN.NET.ID	Dr. Arij Everaarts, APR, General management Telephone +31 320 291 671 Fax +31 320 230 479 E-mail: ARIJ.EVERAARTS@WUR.NL Dr. Andre de Jager, AEI, Supply chain management Telephone +31 70 3358 341 Fax +31 70 3615 624 E-mail: ANDRE.DEJAGER@WUR.NL
Sweet pepper pilot project	Dr.Nikardi Gunadi, IVEGRI Telephone +62 22 2786 245 Fax +62 22 2786 416 E-mail: NGUNADI@BDG.CENTRIN.NET.ID	Ruud Maaswinkel, WUR-Greenhouse Horticulture Telephone +31 317 485 537 Fax +31 105 225 193 E-mail: RUUD.MAASWINKEL@WUR.NL
Shallot pilot project	Dr. Rofik Sinung Basuki, IVEGRI Telephone +62 22 2786 245 Fax +62 22 2786 416 E-mail: ROFIK@HOTMAIL.COM	Lubbert van den Brink, APR Telephone +31 320 291 353 Fax +31 320 230 479 E-mail: LUBBERT.VANDENBRINK@WUR.NL
Hot pepper pilot project	Dr. Witono Adiyoga, IVEGRI Telephone +62 22 2786 245 Fax +62 22 2786 416 E-mail: VICIANTI@YAHOO.CO.ID	Herman de Putter, APR Telephone +31 320 291 614 Fax:+31 320 230 479 E-mail: HERMAN.DEPUTTER@WUR.NL
Supply chain management	Dr. Witono Adiyoga, IVEGRI Telephone +62 22 2786 245 Fax +62 22 2786 416 E-mail: VICIANTI@YAHOO.CO.ID	Dr. Andre de Jager, AEI Telephone +31 70 3358 341 Fax +31 70 3615 624 E-mail: ANDRE.DEJAGER@WUR.NL
Quantitative Economic Analysis	Dr. Witono Adiyoga, IVEGRI Telephone +62 22 2786 245 Fax +62 22 2786 416 E-mail: VICIANTI@YAHOO.CO.ID	Marcel van der Voort, APR Telephone +31 320 291 312 Fax +31 320 230 479 E-mail: MARCEL.VANDERVOORT@WUR.NL
Fruit supply chains	Dr. Sri Yuliani, ICAPRD Telephone +62 251 321762 Fax +62 251 350920 E-mail: S.YULIANI@GMAIL.COM	Dr. Jeroen Knol, ASFG Telephone +31 317 480177 Fax +31 317 483011 E-mail: JEROEN.KNOL@WUR.NL

CONTENTS

Summary

In 2007 research was started on the production of True Seed Shallots in Brebes. The first aim of the research was improve the nursery- and transplanting techniques.
The research on the nursery and transplanting techniques in 2007 was focused on the production and transplanting of seedling clusters in stead of individual seedling. The main problems of transplanting individual seedling are the amount of labour and sometimes the survival of seedlings. Different trays or plastic bags were used to produce soil modules on which the clusters were grown. The sowing of seed in rows on a seedbed was considered as standard.

The results of the trials done in 2007 were influenced very heavily by a severe attack of Spodotera and also by water shortage. The heavy attack of Spodoptera was the consequence of the late start of the trials in the dry season. Transplanting was done in September and at that moment many shallots fields were harvested. Spodoptera was migrating from the harvested fields to the trial.
Some conclusions could be drawn from the research done in 2007:

- Producing press-pots is possible, but the availability of compost-mixture which is needed is so poor that it is not usefull to continue this research.
- In the nursery seed efficiency was rather good in trays (sown in rows; up to 60%). Seed efficiency was lower when sown in rows on a seedbed in the field (ca. 20%). Seed efficiency in trays with compartments was low (ca. 15%); in polybags seed efficiency was 50%.
- If seedlings are raised on trays or on polybags local paddy field soil is difficult to handle. The use of sandy soil mixed up with manure or burned rice husks is preferred.
- It appeared that the survival of transplanted individual seedlings was good: 95% or higher. After transplanting the seedling were extremely wilting.
- After transplanting clusters of seedlings on soil modules (produced in polybags or trays with compartments) wilting was not occurring and survival was ca. 95%.
- The advantage of transplanting clusters of seedlings on soil modules is that growth is less disturbed by transplanting and the crop can be harvested earlier (ca. 1 week).
- Growing shallots in clusters (on soil modules or more than 1 seedling planted in 1 hole) does not have a clear negative influence on the quality. The grading is hardly influenced.
- With respect to labour costs the use of clusters of seedlings on soil modules is not an advantage. Compared to producing individual seedling on a seedbed or in trays more labour is needed in prepairing the polybags. Also transport of clusters on soil modules to the field is less easy as transport of individual seedlings (much more material has to be transported through the ditches). These disadvantages are more important that the fact that less transplanting handlings should be done in the field.
- The yield of TTS in 2007 was lower than the yield of shallots grown from seed bulbs. The low yield was caused by a severe loss of plants caused by the attack of Spodoptera.

1. Introduction

In 2007 research was started on the production of True Seed Shallots in Brebes. The first aim of the research was improve the nursery- and transplanting techniques. Second to this also the perspective of direct sowing of TSS is investigated. However this is done on a limited scale, because it was estimated that farmers are not willing to use direct sowing. The main reason for this is the long growing period (ca. 100 days in stead of 60). In stead of two crops only one “direct-sowing”-crop can be grown in the dry season. Other disadvantages of direct sowing: weed problems, heavy soil that needs much preparation before sowing, no possibilities to protect the seedbed and the young seedlings against heavy rain fall. All growing methods were tested in comparison with the traditional growing of crops raised from seed bulbs.

The research on the nursery and transplanting techniques in 2007 was focused on the production and transplanting of seedling clusters in stead of individual seedling. The main problems of transplanting individual seedling are the amount of labour and sometimes the survival of seedlings. Different trays or plastic bags were used to produce soil modules on which the clusters were grown. The sowing of seed in rows on a seedbed was considered as standard. Broadcasting seed on a seedbed was not considered, because it has already been shown that the emergence is poorer and the harvest of the seedlings is less easy compared to sowing in rows. The trials were done with an open pollinated variety, Tuktuk, which was delivered by East West Seeds Indonesia. New hybrid varieties were not available.

Picture 1. Production field with shallots grown from seed bulbs

2. Materials and methods

2.1. Nurseries

Seed
The seed of Tuktuk was not treated with a fungicide or an insecticide. A germination test was conducted at 20 °C. The germination was 88.4% (mean of 5 times 50 seeds, range 82,0 - 94,0%). Thousand kernel weight of the seed was 3.0 gram.

Seedbulbs
Seedbulbs were used from the local variety Bima curut and the imported variety Ilokos. 1 kg of Bima curut contains 296,4 bulbs (3,5 gram/bulb) and 1 kg of Ilokos 296,4 bulbs (5,2 gram/bulb).

Soil and nursery mixture
In the middle of July it was tried to make a mixture of local (Brebes) soil and compost in a weight ratio of 1:1,5. However the local soil was too stiff and difficult to handle. It was decided to use a lighter, more sandy soil, coming from a farm yard. The compost was obtained in Lembang. Costs of the compost: 7000 Rp per 40 kg. The compost was steamed. On the seedbed on the local soil ca. 450 kg compost was added on a surface of 10 x 1,5 m.

Because of the poor emergence of the first sowing another nursery mixture was used in a second sowing. This mixture consisted of 1 volume local soil and 3.0 volume of compost. On the seedbed of the second sowing the nursery mixture of the first sowing was used.

Table 1. The mixtures and the local soil were analysed.

	pH KCl	N-Kjeldahl	P2O5	K2O	Ca	Mg	% water
Soil sample 1	5.8	0.13	108.2	181.8	45.74	8.55	26.23
Soil sample 2	5.8	0.10	84.8	190.8	50.89	8.96	27.15
Soil sample 3	5.7	0.11	99.3	178.6	52.48	8.65	27.25
Nursery 24-7	6.9	0.25	0.76	0.45	1.98	0.67	36.27
Nursery 19-8	7.0	0.30	0.94	0.78	2.49	1.13	38.88

Picture 2. Nursery for individual seedlings raised on sowing bed.

Picture 3. Nursery for individual seedlings raised on plastic trays of 36 cm x 28 cm

Fertilization
The nurseries sown on 24 July and 19 August were fertilized according to the advice of East West Seeds Indonesia given for Tuktuk: before sowing with 50 gram KCL and 50 gram SP 36/ m2. The nursery mixture in the plastic bags and the trays were fertilized with NPK (15+15+15). One teaspoon (ca. 20 g) per 10 liter water was used. Fertilization was done two times.

Pesticides
The nurseries sown on 24 July and on 19 August were both treated with carbufuran, 5 grams per m2 of nursery.

The nursery sown on 24 July was sprayed on 10 August with Score against Alternaria. Spraying against Spodoptera was not done in the sowing of 24 July. In the second sowing spraying was done two times.

The sowing of 19 August was treated with an insecticide mixed up with rice flour against molecricker.

Seedbed, plastic bags and trays
In table 2 an overview is given of the different nursery systems.

Table 2. Overview of nursery systems

	Code of treatment in which seedling used	Size of trays	Diameter of units	Depth of units/soil	Price in Rp
Individual seedlings on seedbed	T1, T2, T8, T13	-	(Sowing on rows, distance between rows: 10 cm)		
Individual seedlings in plastic trays	T1, T2, T8, T13	28 cm x 36 cm	(Sowing on 5 rows, distance between rows: 7 cm)	7,5 cm	10000-15000/ tray
Clusters on plastic bags	T3, T12	-	5 cm,	8 cm	4/bag
Clusters on trays with small units	T4, T5, T6	128 units	3 cm	4 cm	14000/ tray
Clusters on trays with tall units	T7, T11	70 units	5 cm	5 cm	12000/ tray

After sowing on 24 July the trays and boxes with plastic bags were placed on a bamboo table. It appeared that this was causing rapid drying. After the sowing on 19 August the boxes and trays were placed on the soil.

Picture 4. Nursery for clusters of seedlings raised on plastic bags

Picture 5. Clusters of seedlings on plastic bags

Sowing density

On the seedbed the seed was sown on rows, distance between rows 10 cm. On both nurseries (sown 24 July and 19 August) per 1,5 m-row 375 seeds (1,125 gram) was sown. This means 2500 seeds per m2.

In the plastic trays of 28x36 cm 5 rows were sown, distance between the rows 7 cm. On both nurseries (sown 19 July and 24 August) per 28 cm-row 67 seeds (0,2 gram) was sown. This means 3309 seeds per m2.

On 24 July the number of seeds sown in the plastic bags and in the trays with 3 and 5 cm units were according to the treatments. On 19 August in all units 10 seeds were sown.

On 24 July 1 plot of 10 m x 1,5 m was used for a direct sowing trial. It was not possible to sow on the local soil at that moment. Compost was given to this bed, ca 200 kg on a bed of 10 x 1,5 m. The distance between the rows was 20 cm. Per row of 1.5 m 75 seeds were sown (250 seeds/m2).

Picture 6. Overview of the nursery sown on August 24.

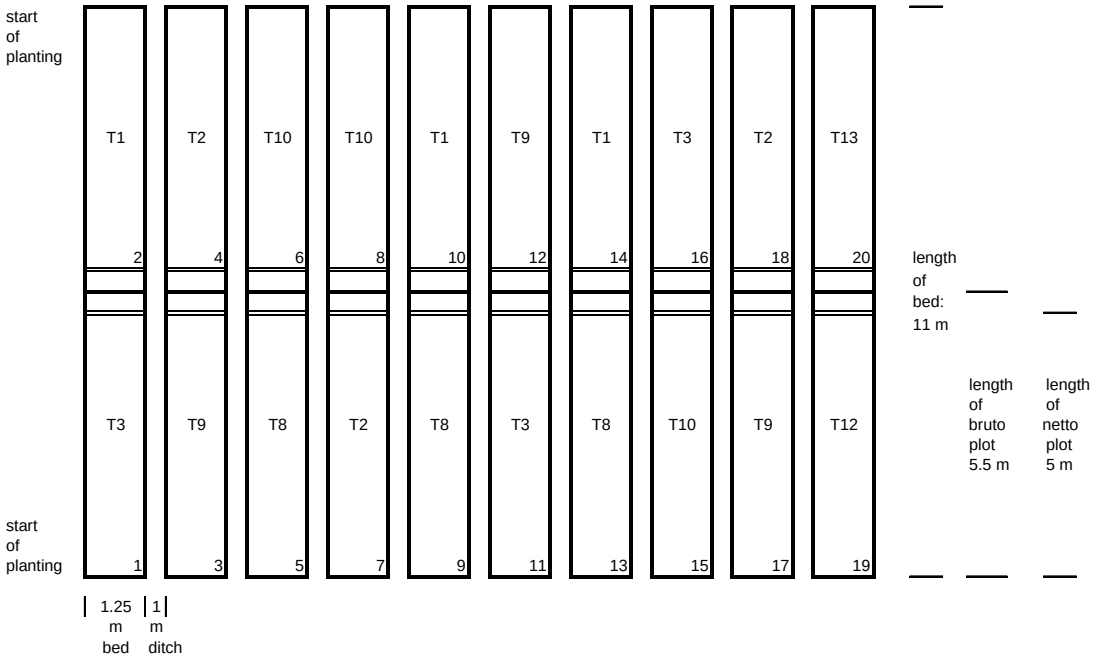
Picture 7. Plastic trays on which TSS is sown on rows

2.2. Transplanting experiments

Transplanting experiment 1

On 6 and 7 September the first transplanting experiment was started. The soil was rather fine. No organic material was added to the soil. In figure 1 the trial scheme is shown.

Figure 1. Production Trial 1 established from nursery sown on 24 July; planting date 6 september 2007



Description of the treatments:
T1: Single seedlings per hole 100 seedlings per m2; plant spacing 10 x 10; distance between rows 10 cm; 55 rows of 12 holes; 100 plants/m2
T2: Single seedlings per hole 167 seedlings per m2; plant spacing 10 x 6; distance between rows 10 cm; 55 rows of 18 holes; 160 plants/m2
T3: Polybags with 4 or more seedlings (mean 4.7); plant spacing 21.4 x 22; distance between rows 22 cm; 25 rows of 6 holes; 99,7 plants/m2
T8: Single seedlings, 4 seedlings per hole; plant spacing 21.4 x 19; distance between rows 19 cm; 28 rows of 6 holes; 98,2 plants/m2
T9: Bulb seed of local variety Bima curut; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 8 holes; 33,3 plants/m2
T10: Bulb seed of imported variety Ilokos; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 8 holes; 33,3 plants/m2
T12: Polybags with 3 seedlings; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 8 holes; 100 plants/m2
T13: Single seedlings, 3 seedlings per hole; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 8 holes; 100 plants/m2

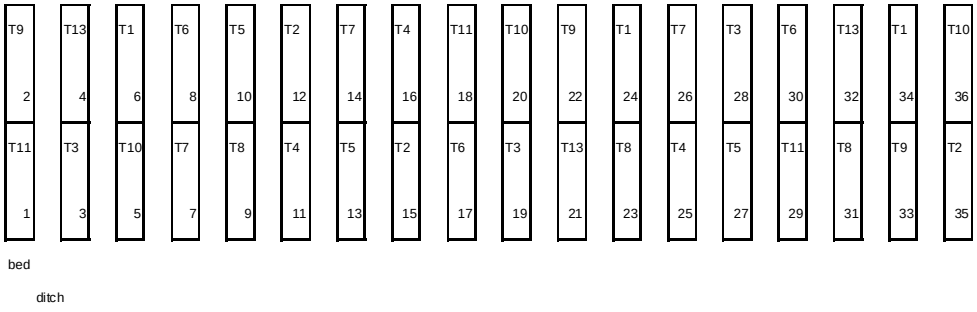
Picture 8. Transplanting of clusters of seedlings raised on plastic bags; 21,2 clusters per m2

Picture 9. Transplanting of individual seedlings (100 per m2) raised on seedbed

Transplanting trial 2

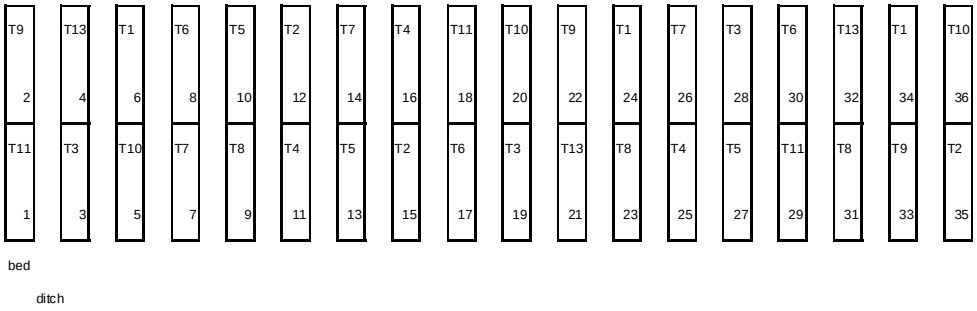
On 25/26 September the second transplanting experiment was started. No organic material was added to the soil. In figure 2 the trial scheme is shown.

Figure 2. Production trial 2 established from nursery sown on 19 august; moment of transplanting:...october



Description of the treatments:
T1: Single seedlings per hole 100 seedlings per m2; plant spacing 10 x 10; distance between rows 10 cm; 55 rows of 15 holes; 825 holes in bruto plot; 100 plants/m2
T2: Single seedlings per hole 160 seedlings per m2; plant spacing 10 x 6; distance between rows 10 cm; 55 rows of 25 holes; 1375 holes in bruto plot; 160 plants/m2
T3: Polybags with 4 or more seedlings (mean 4 estimated); plant spacing 21.4 x 19; distance between rows 19 cm; 28 rows of 7 holes; 196 holes in bruto plot; ca 100 plants/m2
T4: 3 cm modules with 3 seedlings; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 10 holes; 270 holes in bruto plot; 100 plants/m2
T5: 3 cm modules with 4 seedlings; plant spacing 21.4 x 19; distance between rows 19 cm; 28 rows of 7 holes; 196 holes in bruto plot; 100 plants/m2
T6: 3 cm modules with 4 seedlings; plant spacing 12.5 x 20; distance between rows 20 cm; 27 rows of 12 holes; 324 holes in bruto plot; 160 plants/m2
T7: 5 cm modules with 4 seedlings; plant spacing 12.5 x 20; distance between rows 20 cm; 27 rows of 12 holes; 324 holes in bruto plot;160 plants/m2
T8: Single seedlings, 4 seedlings per hole; plant spacing 21.4 x 19; distance between rows 19 cm; 28 rows of 7 holes; 196 holes in bruto-plot; 98,2 plants/m2
T9: Bulb seed of local variety Bima curut; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 10 holes; 270 holes in bruto-plot; 33,3 plants/m2
T10: Bulb seed of imported variety Ilokos; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 10 holes; 270 holes in bruto-plot; 33,3 plants/m2
T11: 5 cm modules with 5 seedlings; plant spacing 16.7 x 18.8; distance between rows 18.8 cm; 29 rows of 9 holes; 261 holes in bruto plot; 160 plants/m2
T13: Single seedlings, 3 seedlings per hole; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 10 holes; 270 holes in bruto plot; 100 plants/m2

Figure 2. Production trial 2 established from nursery sown on 19 august; moment of transplanting:...october



Description of the treatments:
T1: Single seedlings per hole 100 seedlings per m2; plant spacing 10 x 10; distance between rows 10 cm; 55 rows of 15 holes; 825 holes in bruto plot; 100 plants/m2
T2: Single seedlings per hole 160 seedlings per m2; plant spacing 10 x 6; distance between rows 10 cm; 55 rows of 25 holes; 1375 holes in bruto plot; 160 plants/m2
T3: Polybags with 4 or more seedlings (mean 4 estimated); plant spacing 21.4 x 19; distance between rows 19 cm; 28 rows of 7 holes; 196 holes in bruto plot; ca 100 plants/m2
T4: 3 cm modules with 3 seedlings; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 10 holes; 270 holes in bruto plot; 100 plants/m2
T5: 3 cm modules with 4 seedlings; plant spacing 21.4 x 19; distance between rows 19 cm; 28 rows of 7 holes; 196 holes in bruto plot; 100 plants/m2
T6: 3 cm modules with 4 seedlings; plant spacing 12.5 x 20; distance between rows 20 cm; 27 rows of 12 holes; 324 holes in bruto plot; 160 plants/m2
T7: 5 cm modules with 4 seedlings; plant spacing 12.5 x 20; distance between rows 20 cm; 27 rows of 12 holes; 324 holes in bruto plot;160 plants/m2
T8: Single seedlings, 4 seedlings per hole; plant spacing 21.4 x 19; distance between rows 19 cm; 28 rows of 7 holes; 196 holes in bruto-plot; 98,2 plants/m2
T9: Bulb seed of local variety Bima curut; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 10 holes; 270 holes in bruto-plot; 33,3 plants/m2
T10: Bulb seed of imported variety Ilokos; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 10 holes; 270 holes in bruto-plot; 33,3 plants/m2
T11: 5 cm modules with 5 seedlings; plant spacing 16.7 x 18.8; distance between rows 18.8 cm; 29 rows of 9 holes; 261 holes in bruto plot; 160 plants/m2
T13: Single seedlings, 3 seedlings per hole; plant spacing 15 x 20; distance between rows 20 cm; 27 rows of 10 holes; 270 holes in bruto plot; 100 plants/m2

3. Results

3.1. Nurseries

Emergence in the nurseries

In table 3 the emergence of the seedbed nursery is shown. On average the percentage of emergence was 22%. This low percentage was probably caused by the high temperatures which were occuring after sowing (up to 45 C), in combination with the fact that the frequency of watering was too low (1 time per day). The seedling density was 553 seedlings per m2.

Table 3. Percentage emergence nursery on seedbed

	Sample of seedling emergence (row number)										% Average
Row number	**31**	**51**	**97**	**50**	**38**	**42**	**26**	**35**	**8**	**55**	
Seedlings emergence	77	79	84	89	56	65	97	97	100	88	**83**
%	21	21	22	24	15	17	26	26	27	23	**22**

Plot size = 1.5 m x 10 m
Row spacing = 10 cm (numbe rof row = 100)
Number of Seed sown = 1.125 gram or 375 seeds

In table 4 the emergence in the plastic trays (individual seedling production on seedbed in a tray) is shown. On average the percentage of emergence was 63%. The seedling density was 2081 seedlings per m2.

Table 4. Percentage emergence seedbed in trays; sowing date 19 July

Tray	Seedlings Established	% emergence	
1	44	66.0	
2	43	64.5	
3	43	64.5	
4	42	63.0	
5	43	64.5	
6	36	54.0	
7	40	60.0	
8	35	52.5	
9	47	70.5	
10	45	67.5	
11	55	82.5	
12	43	64.5	
13	40	60.0	
14	43	64.5	
15	45	67.5	
16	42	63.0	
17	40	60.0	
18	37	55.5	
19	40	60.0	
20	40	60.0	
21	32	48.0	
22	42	63.0	
23	46	69.0	
24	44	66.0	
25	42	63.0	TRAY
Mean		**62.9**	62.9

Seedsown per tray = 1 gram; size trays: 28 cm x 36 cm= 0,1 m2
Per tray 5 rows
Per row 0.2 gram seed 67 seeds/row

The emergence in the plastic bags and in the trays with 3 cm and 5 cm diameter is shown in table 5.

Table 5. Percentage emergence in plastic bags and in trays with 3 cm and 5 cm units

	Mean % emergence	minimum number of seedlings	maximum number of seedlings	Number of counted units
Plastic bags, 5 seeds	48.5	0	6	168
Trays with 5 cm units, 6 seeds	13.3	0	5	250
Trays with 5 cm units, 5 seeds	13.9	0	5	350
Trays with 3 cm units, 5 seeds	13.1	0	4	288

The emergence in the trays with diameters of 3 and 5 cm was very poor.

The emergence of the nursery sown on 19 July was very poor. This was caused by the weather conditions. It was very hot and dry at that time. Especially the trays were drying very fast. The trays and plastic bags were placed on a bamboo table.

It was decided to sow another nursery and to adapt some improvements: The trays and plastic bags were not placed on a bamboo table but on the soil and the watering frequency was increased to 2 till 3 times a day.

The emergence of the second sowing was much better.

3.2. Transplanting experiments

On 6 September some characteristics of the seedlings raised on the seedbed on the soil were observed. These seedlings were used in field experiment 1. Plants with 4 leafs or more were selected for transplanting. The seedlings raised on the plastic trays were less vigourous, because of the drought.

Table 6. Characteristics of the seedlings planted in field experiment 1; seedlings from seedbed on the soil

	Number of observed seedlings	Mean	Standard deviation	minimum	maximum
Number of leafs	52	4.0	0.7	2	5
Length of seedlings (cm)	52	33.6	6.0	17	44
Diameter of seedlings (mm)	52	4.6	1.0	2	6
Fresh weight of seedlings (gram)	25	2.8	0.9	1.6	4.4

Picture 10. Individual seedlings planted on

Picture 11. Cluster of seedlings on soil module with removed

September 6. *plastic bag; September 6.*

The clusters on soil modules raised on the plastic bags were also transplanted. Clusters with 4 seedlings or more were selected for transplanting. The mean number of seedlings per cluster was 4.7. The soil modules were stable after removing the plastic bag. Roots could be seen coming out of the soil modules. Clusters with 3 seedlings were transplanted in an observation plot.
Shortly after transplanting it was very clear that the individual seedlings were wilting extremely, while the seedlings on the soil modules were still looking fresh. The wilted leafs of the individual seedlings died and regrowth was done by younger leafs.

The survival of plants after transplanting was scored 12 days after transplanting. The results are shown in table 7. The treatments in which 3 or 4 seedlings were planted in one hole are showing the worst survival: about 90%. The other treatments were better: 95%. There was no difference in survival between the seedlings in the clusters on soil modules and the individual seedlings.

Table 7. Field experiment 1. Survival of seedlings after transplanting and % of leaf attacked by pest and diseases

	% survival of seed-lings; 12 days after planting	% of leaf attacked by pest and diseases			
		Spodoptera		Lyriomyza	Alternaria
		20-sep	5-okt	20-sep	5-okt
T1: 100 seedlings/m2	95.4	47	33	23	25
T2: 160 seedlings/m2	95.7	50	40	25	23
T3: clusters (4.7on soil);100 s/m2	95.0	33	35	20	22
T8: 4 seedlings/hole; 100 s/m2	90.1	47	35	20	18
T9: Bima curut 33.3 bulbs/m2	99.6	17	22	7	28
T10: Ilokos 33,3 bulbs/m2	100.0	7	20	3	32
T12: clusters (3 on soil); 100 s/m2	96.3	30	30	25	20
T13: 3 seedlings/hole; 100 s/m2	91.5	45	25	20	15

About 30 days after transplanting several plants were dying because of pest and diseases, especially Spodoptera, but also Fusarium and Alternaria.
On 20 september and 5 oktober the percentage of leaf attacked by pest and diseases was scored visually. It appeared that especially the attack by Spodoptera was very severe. This can be caused by the late planting of the trial. When the surrounding fields with shallots were harvested Spodoptera was attracked by the young plants in the trial. Also the light sharp colour of Tuktuk could have attracked Spodoptera. It was obvious that Bima curut and Ilokos suffered less from Spodoptera and also Lyriomyza.

Picture 12. Single seedlings transplanted in Clusters of 3 per hole.

Picture 13. Planting of seed bulbs

Because of the differences between the treatments in earliness the harvest was done on 3 different moments. On 30 oktober T9 and T10 were harvested. On 7 November the treatments T3 and T13 were harvested. The treatments T1, T2 and T12 were harvested on 13 November. Harvesting was done at the moment of 75% fall over of leafs. In table 8 the earliness, yield and grading results are shown.

Table 8. Field experiment 1. Earliness, yield, number of harvested shallots and grading.

		Earliness	Shallots with leaves		Shallots	Number	Grading (weight%)			
		days until harvest	3 days after harvest Yield kg/100m2	7-19 days after harvest Yield kg/100m2	(without leafs) Yield kg/100m2	of shallots harvested per m2	5-15 mm	15-25 mm	25-35 mm	>35 mm
T1	Tuk tuk Single seedlings 100/m2	68	75.12	52.32	50.40	47.3	0.0	41.1	52.9	6.0
T2	Tuk tuk Single seedlings Tuk tuk 160/m2	68	112.92	78.60	70.80	77.8	0.0	40.2	56.1	3.7
T3	Tuk tuk Clusters of 4.7 seedlings plastic bags; 100 pl/m2	62	91.32	60.12	57.84	54.6	0.0	42.6	49.8	7.5
T8	Tuk tuk Single seedlings planted 4/hole; 100 pl/m2	68	36.36	26.16	22.56	26.5	0.0	62.2	36.5	1.3
T9	Bima curut 33,3 bulbs/m2	54	120.72	70.32	64.44	184.4	13.4	86.9	0.7	0.0
T10	Ilokos 33,3 bulbs/m2	54	149.76	93.12	82.68	276.8	9.7	90.3	0.0	0.0
F probability (Anova)			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.073
LSD 5%			19.896	18.084	18.192	27.612	2.92	17.77	10.96	5.93
Observation on 1 plot (to compare)*										
T12	Tuk tuk Clusters of 3 seedlings plastic bags; 100 pl/m2	62	139.68	96.00	72.72	59.76	0.0	20.0	72.0	8.0
T13	Tuk tuk Single seedlings planted 3/hole; 100 pl/m2	68	145.44	73.44	66.96	56.64	0.0	17.4	69.6	13
	Direct sowing 7,5 kg/ha; row-distance: 20 cm	98	275.64	151.32	136.68	144.48	0.0	38.8	58.5	2.7
	Seedbed, remaining plants	98	341.04	187.68	190.56	172.92	0.0	26.4	71.3	2.3

*: results obtained on 1 observation plot; results are less reliable than the results of the trial

The number of harvested shallots per m^2 is extremely low. Assuming that most Tuktuk plants are giving 1 bulb per plant it appears that in the treatments T1, T2 and T3 only ca. 50% of the plant have given a harvestable bulb. In T8 this is even lower: ca. 25%. Between the moment of scoring the survival of plants and the harvest many plant died or were growing so badly that no bulb could be harvested. This is probably caused by several factors: dry hot weather conditions, problems in water supply and severe attack by pest and diseases, especially Spodoptera. Another factor which could have played a role is the planting depth of the seedlings. It appeared that several seedlings were planted too deep. Also the soil structure could have played a role.
The ranking in number of harvested bulbs is corresponding well with the yield.

The yield of the trial is extremely low, ca. 50% of what is probably possible. It is clear that with such a low yield level it is hard to conclude anything about the potential of the treatments.

The seed bulb varieties Bima curut and Ilokos had a field period of 54 days. The field period of the treatments in which individual seedlings were planted (T1, T2 and T12) was 68 days. The crops growing from clusters on soil modules had a field period of 62 days. The use of clusters on soil modules can give a crop which can be harvested more early.

On 5 december in Field Experiment 2 the crop performance was visually scored. In table 9 the results are given. At that moment the treatments obtained with seed bulbs were already harvested. Also in this trial much damage was caused by Spodoptera and other diseases.

Table 9. Field experiment 2. Visual scoring crop performance on 5 december

	Rep 1	Rep 2	Rep 3	Mean
Tuk tuk Single seedlings 100/m2	2	6	6	4.7
Tuk tuk Single seedlings Tuk tuk 160/m2	7	7	7	7.0
Tuk tuk Clusters of 4.7 seedlings plastic bags; 100 pl/m2	6	8	7	7.0
Tuk tuk Clusters of 3 seedlings 3 cm tray; 100 pl/m2	4	2	6	4.0
Tuk tuk Clusters of 4 seedlings 3 cm tray; 100 pl/m2	5	6	3	4.7
Tuk tuk Clusters of 4 seedlings 3 cm tray; 160 pl/m2	6	7	7	6.7
Tuk tuk Clusters of 4 seedlings 5 cm tray; 160 pl/m2	9	8	8	8.3
Tuk tuk Single seedlings planted 4/hole; 100 pl/m2	1	0.5	1	0.8
Tuk tuk Clusters of 5 seedlings 5 cm tray; 160 pl/m2	8	7	9	8.0
Tuk tuk Single seedlings planted 3/hole; 100 pl/m2	1	1	1	1.0

Field experiment 2 was harvested on 15 December. In Table 10 the yield data are given.

Results shallot trial 2, planting time october 2007

		Shallots with leaves			Shallots	Number	Grading (weight%)			
		At harvest Yield kg/100m2	3 days after harvest Yield kg/100m2	7 days after harvest Yield kg/100m2	(without leafs) Yield kg/100m2	of shallots per m2	5-15 mm	15-25 mm	25-35 mm	>35 mm
T1	Tuk tuk Single seedlings 100/m2	57.1	43.2	39.6	29.3	24.0	0.0	43.7	45.4	10.5
T2	Tuk tuk Single seedlings Tuk tuk 160/m2	144.0	122.3	111.2	100.2	75.3	0.0	27	65.4	7.6
T3	Tuk tuk Clusters of 4.7 seedlings plastic bags; 100 pl/m2	100.3	78.1	73.2	*	*	*	*	*	*
T4	Tuk tuk Clusters of 3 seedlings 3 cm tray; 100 pl/m2	53.4	41.3	38.6	*	*	*	*	*	*
T5	Tuk tuk Clusters of 4 seedlings 3 cm tray; 100 pl/m2	42.0	33.2	29.4	*	*	*	*	*	*
T6	Tuk tuk Clusters of 4 seedlings 3 cm tray; 160 pl/m2	78.6	65	60	*	*	*	*	*	*
T7	Tuk tuk Clusters of 4 seedlings 5 cm tray; 160 pl/m2	126.2	105.1	95.5	79.6	52.7	0.0	13.9	75.3	10.9
T8	Tuk tuk Single seedlings planted 4/hole; 100 pl/m2	7.6	5.1	4.7	*	*	*	*	*	*
T9	Bima curut 33,3 bulbs/m2	212.2	147.2	135.8	125.7	236.9	6.5	85.5	8.0	0.0
T10	Ilokos 33,3 bulbs/m2	225.2	155.9	141.1	126.8	412.1	16.2	83.4	0.4	0.0
T11	Tuk tuk Clusters of 5 seedlings 5 cm tray; 160 pl/m2	144.1	88.9	81.4	61.3	47.3	0.0	34.7	57.1	8.0
T13	Tuk tuk Single seedlings planted 3/hole; 100 pl/m2	17.4	12.3	11.3	*	*	*	*	*	*
F probability (Anova)		<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
LSD 5%		39.45	29.44	28.35	38.29	72.87		35.88	22.68	2.45

*: not measured

Also Field experiment 2 has suffered a lot from Spodoptera and from water shortage. Also in this trial many plants were dying and were not able to produce bulbs to be harvested. The yield level was low. TSS Tuk tuk grown at 160 plants per m2 was giving the highest yield within the TSS-treatments, but this yield was lower than the yield of Bima curut and Ilokos grown from seed bulbs. Because of the big influence of Spodoptera and water shortage conclusion can not be draw about the perspectives of TSS.

4. Other experiments

Production of press-pots
At the start of the project the possibilities of producing compact soil modules (press-pots) was investigated. In Western Europe transplants of onion are grown on compact soil modules produced by pressing a wet mixture of soil and peat in such a way that the soil modules keep intact for several weeks without using pots or plastic bags. On a small scale it was tested if press pots could be produced. The advantages of clusters of seedlings on press pots could be: no material costs for polybags or trays with compartments, better survival after transplanting, less wilting after transplanting, less labour at transplanting. It was possible to produce press-pots, but it appeared that the availability of the compost needed for this press-pot was so poor in Brebes that it is decided to stop research with press-pots.

Picture 14. Press-pots made with hand-equipment.

Clusters of seedlings produced at the moment of transplanting
Tests were also done to investigate the possibility of producing clusters of seedlings on soil modules which were produced at the moment of transplanting. The idea was to sow seeds in such a way in trays that separate clusters of 3-4 seedlings were produced. At the moment of transplanting soil modules would be made by cutting the (wetted) nursery mixture in soil modules in such a way that on each soil module a cluster of seedlings is present. On 5 October a trial was sown in trays (28 cm x 36 cm). In the trays seeds were sown in holes made in the nursery mixture. Per tray 30 holes were made and in each hole 6 seeds were sown. In the trial four nursery mixtures were included to investigate which mixture was giving the best results. Fertilization and control of pests and diseases was done in the same way as the two nurseries for the transplanting trials. The trial was done in 3 replicates, each replicate 1 tray. In table 11 the emergence in this trial is given.

At the moment of transplanting it was tried if the soil could be cut in such a way that soil-modules were obtained. It appeared that the mixture with the best emergence was the worst in stability of the soil modules. It was not completely clear if this stability was too less to give good transplanting results.

Experiments with direct sowing

On 24 July 1 bed of 11 m x 1.5 was sown to observe a direct seeding production of TSS. The seed bed was improved by adding nursery mixture. Sowing was done in 55 rows; distance between the rows was 20 cm. In each row 75 seeds were sown. Three weeks after sowing the emergence was determined. The results are given in table 11. The plant density at that moment was 113 plants per m2.

Figure 17. Example of the soil conditions

Figure 18 . Plant density in direct sowing plot

Table 9. Percentage emergence in direct sowing plot, sown 24 july

	Sample of seedling emergence (row number)										% Average
Row numb	**7**	**13**	**15**	**17**	**20**	**27**	**28**	**32**	**44**	**52**	
Seedlings e	48	17	39	42	36	24	28	41	45	16	**34**
%	64	23	52	56	48	32	37	55	60	21	**45**

Plot size = 1.5 m x 11 m
Row spacing = 20 cm (numbe rof row = 55)
Number of Seed sown = 75 seeds

The plot was harvested on 30 October. The yield was on a rather good level: 27,6 ton/ha. The growing period was 98 Days. However it must be stated that the direct sowing plot was not really representing direct sowing conditions. The soil was improved with much more compost. This is not possible to do for a great area.

On 5 October an observation trial with different ways of direct sowing was sown. On 6 December the number of plants was counted.

Table 4. Number of plants; mean of 10 rows; 100 seeds/row

	without rice straw	with rice straw
Furrow 1 cm deep, closed with burned rice husks	35.0	13.0
Furrow 2.5 cm deep, closed with burned rice husks	19.6	4.4
Furrow 2.5 cm deep, not closed	14.5	7.8
Row with 16 holes of 1 cm deep, 6 seeds/hole, closed with burned rice husks	12.6	8.9

Sowing on a depth of 1 cm, closing the furrow after sowing with burned rice husks and leaving the seedbed uncovered with rice straw was giving the best result.

Figure 3. Trial with different ways of direct sowing. In first bed (without covering with rice straw) from the left to the right: Furrow 1 cm deep (closed with burned rice husks), Furrow 2.5 cm deep (closed with burned rice husks), Furrow 2.5 cm deep (not closed). The second bed: the same treatments with covering with rice straw.

5. Conclusions Research 2007

The results of the trials done in 2007 were influenced very heavily by a severe attack of Spodotera and also by water shortage. The heavy attack of Spodoptera was the consequence of the late start of the trials in the dry season. Transplanting was done in September and at that moment many shallots fields were harvested. Spodoptera was migrating from the harvested fields to the trial.
Some conclusions could be drawn from the research done in 2007:

- Producing press-pots is possible, but the availability of compost-mixture which is needed is so poor that it is not usefull to continue this research.
- In the nursery seed efficiency was rather good in trays (sown in rows; up to 60%). Seed efficiency was lower when sown in rows on a seedbed in the field (ca. 20%). Seed efficiency in trays with compartments was low (ca. 15%); in polybags seed efficiency was 50%.
- If seedlings are raised on trays or on polybags local paddy field soil is difficult to handle. The use of sandy soil mixed up with manure or burned rice husks is preferred.
- It appeared that the survival of transplanted individual seedlings was good: 95% or higher. After transplanting the seedling were extremely wilting.
- After transplanting clusters of seedlings on soil modules (produced in polybags or trays with compartments) wilting was not occurring and survival was ca. 95%.
- The advantage of transplanting clusters of seedlings on soil modules is that growth is less disturbed by transplanting and the crop can be harvested earlier (ca. 1 week).
- Growing shallots in clusters (on soil modules or more than 1 seedling planted in 1 hole) does not have a clear negative influence on the quality. The grading is hardly influenced.
- With respect to labour costs the use of clusters of seedlings on soil modules is not an advantage. Compared to producing individual seedling on a seedbed or in trays more labour is needed in prepairing the polybags. Also transport of clusters on soil modules to the field is less easy as transport of individual seedlings (much more material has to be transported through the ditches). These disadvantages are more important that the fact that less holes should be made in the field.
- The yield of TTS in 2007 was lower than the yield of shallots grown from seed bulbs. The low yield was caused by a severe loss of plants caused by the attack of Spodoptera.