HORTIN II Co Innovation Programme

Towards cost effective, high quality value chains

Effect of variety, transplant raising, screen net, mulch and cropping system on hot pepper growth and yield

HORTIN-II Research Report nr. 15

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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

From March till October 2009, an experiment was carried out in lowland area at Kersana Brebes, Central Java to investigate the effect of transplant use, cropping system, mulch and screen net on plant growth and yield of hot pepper (Capsicum annuum). Used varieties in the experiment were Tit Segitiga, a local open pollinated variety and Gada, a hybrid variety. Hot pepper transplants were raised in trays or in plastic bags inside a nursery. At the same time hot pepper was directly sown in the field. Transplants showed a lower fresh weight and were smaller than the seedlings from direct sowing. Seedlings with direct sowing showed a higher percentage of affected plants by thrips. Yield of transplants was not different from the yield present with direct sowing.

Farmers practice of intercropping hot pepper with shallot was compared with monocropping, where plant density of the hot pepper was kept the same. Monocropping showed a lower yield than intercropping which is probably due to a better plant establishment of hot pepper in an intercrop. The intercrop functions as some kind of protection of the young seedlings against high temperatures present at the location.

Black mulch was applied in combination with the monocropping system, in order to reduce the amount of water needed for irrigation and for weed suppression. Results showed that compared to bare soil, a higher total production but a same marketable yield is present. Compared to the intercropping cultivation a lower yield is still present with monocropping and mulch combined.

The use of screen net covers in the field had the biggest impact on hot pepper yield. A bamboo framework was placed overhead the plants and an screen net was placed over this framework. Plants showed a better growth inside this screen net cover and yield was with 24 t/ha significant higher than the yield in the open field were 4 t/ha hot pepper was harvested.

1 Introduction

In 2007 the HORTIN II project was initiated in order to improve the hot pepper supply chain.
A main constraint in the supply chain was the low and fluctuating production of hot pepper (*Capsicum annuum*). Farmers indicated that yield is low due to the lack of good starting material and to the presence of pests and diseases. Currently open pollinated varieties are used instead high yielding hybrid varieties due to the high seed use and related seed costs of these varieties when cultivated with direct sowing. With direct sowing per plant hole five seeds are sowed, meaning that only 20 % of the seeds is resulting in a plant while the other 80% is wasted. Due to the use of direct sowing at which a high amount of seeds is required the use of hybrid varieties of which seed costs are much higher is not acceptable to the farmers. When using transplants, seed use can be reduced, since a higher percentage of seeds will result in a good plant per desired position. Next to savings on seed use yield may increase due to a possible better performance of hybrid varieties. Not only productivity might be higher but also resistance against pests and diseases might b higher as compared to local open pollinated varieties, resulting in even higher yields.
A location near the city of Brebes was selected for the experimental site, since it is estimated that approximately 40% of the hot pepper production of Java takes place here. Hot pepper is considered as a secondary crop by the local farmers and is used to intercrop with shallot which is considered the main crop. Rotation takes place with rice and sugar cane. In general the climate in Brebes is suitable for hot pepper cultivation except for the months December and January when heavy rainfall is present. Hot pepper main season only starts after April when the rice is harvested.
Since August 2007 experiments have been carried out to test the effect of container, variety and media on transplant raising of hot pepper. From these experiments concluded could that raising seedlings in individual plastic bags gave the best results. However, in terms of cost-benefit the use of trays may be more efficient. Less time is required for filling trays with media and cost price of the materials seems also lower. For media a mixture of 1 volume part of manure and 1 volume part of top soil resulted in the highest percentage of usable transplants. The hybrid variety Gada gave a higher yield per plant compared to Tit Segitiga. Per square meter, where Gada plant population was 50% of the population present with Tit Segitiga, yield was similar. However, yield is still not optimal since due to the presence of pests and diseases average yield is not exceeding 2 to 4 ton per hectare whereas under favourable conditions 5 to 6 tonnes are possible. In 2007 and early 2008 observed was that mainly thrips and *helicoverpa* were present in the cop. Commonly those pests are controlled by field application of insecticides. However, the effect of these sprayings seems to be limited and frequent spraying, up to twice a week, is common practice.
Because of the poor field conditions decided was to pay more attention on cultivation improvements as well. The use of screen net, mulch and monocropping may be possible improvements.
Mulch uses can have a positive effect on weed, pest and disease suppression and on water use. With the use of screen net the crop is more protected against in-flight of several pest insects. Also it gives shade and might reduce crop temperature. Therefore temperature is more optimal for fruit set and also it might have a positive influence on water use efficiency. Finally with mono cropping plants don't have to compete with a second crop for space, nutrients and water. Also timing of pesticide and fertilizer application can be optimized.

With this experiment the aim was to:

- Test the effect of variety on seedling production and yield
- Test the effect of type of container on seedling raising
- Test the effect of mulching on yield
- Test the effect of screen net on yield
- Test the effect of monocropping on yield

1.1 Acknowledgements

The research was done in close cooperation with farmers in Brebes. PT EWINDO supplied materials for the nursery construction and seeds of the hybrid hot pepper variety Gada F_1. Rien Rodenburg of PT EWINDO offered valuable advice on hot pepper cultivation. PT Syngenta also assisted the research by supplying pesticides and advice on pest control.

Special thanks also to Uka and Arifin for their important role in the cultivation of the hot pepper crop and carrying out the experiment and in assisting with the observations.

2 Materials and methods

The experiment was performed in the area of Kersana Brebes (Fig. 1) . Brebes is located on the northern coast of Java adjacent to the Java Sea at 7° S and 109° E. The climate can be classified as a humid tropical lowland climate with clear distinguished dry and wet seasons. A field was rented from farmers and the nurseries were constructed at the entrance of the field while the production fields were located behind the nurseries (Fig. 2). Soil type of the field can be characterized as a fluvisol with 70% clay. According to the classification by the Indonesian Soil Research Institute (1961) the soil is an alluvial soil with river and lake sediments in flat or slanting areas.

Figure 1. Location of the hot pepper cultivation area where the experiment took place.

In February 2009 soil samples were taken from the experimental site (Table 1). Three samples were taken from the field of the top layer of 0 – 30 cm depth. Sampling was done by taking 5 sub samples along the diagonal of each replication. Soil pH-H_2O is slight acid to neutral. Phosphate content of the soil is present at an excessive level while potassium is present at an adequate medium level. Finally, both calcium and magnesium content is ranging from medium to high. An amount of 40.8 kg/ha mineral nitrogen was present in the soil just before commencing cultivation.

Table 1. Analyse results of soil samples taken in February 2009 at the experimental site.

Sample	pH-H_2O	pH-KCl	N (%) Kjeldahl	N-min (ppm) KCL 1N	P_2O_5 (ppm) Olsen	K_2O (ppm) MV	CaO (cmol/kg) Ammonium acetate 1N pH 7	MgO
I	7.0	5.7	0.11	10.0	102	215	53	16
II	7.1	5.6	0.11	8.8	93	267	55	17
III	7.1	5.7	0.10	8.7	83	248	56	18
mean	7.0	5.7	0.11	9.2	93	243	55	17

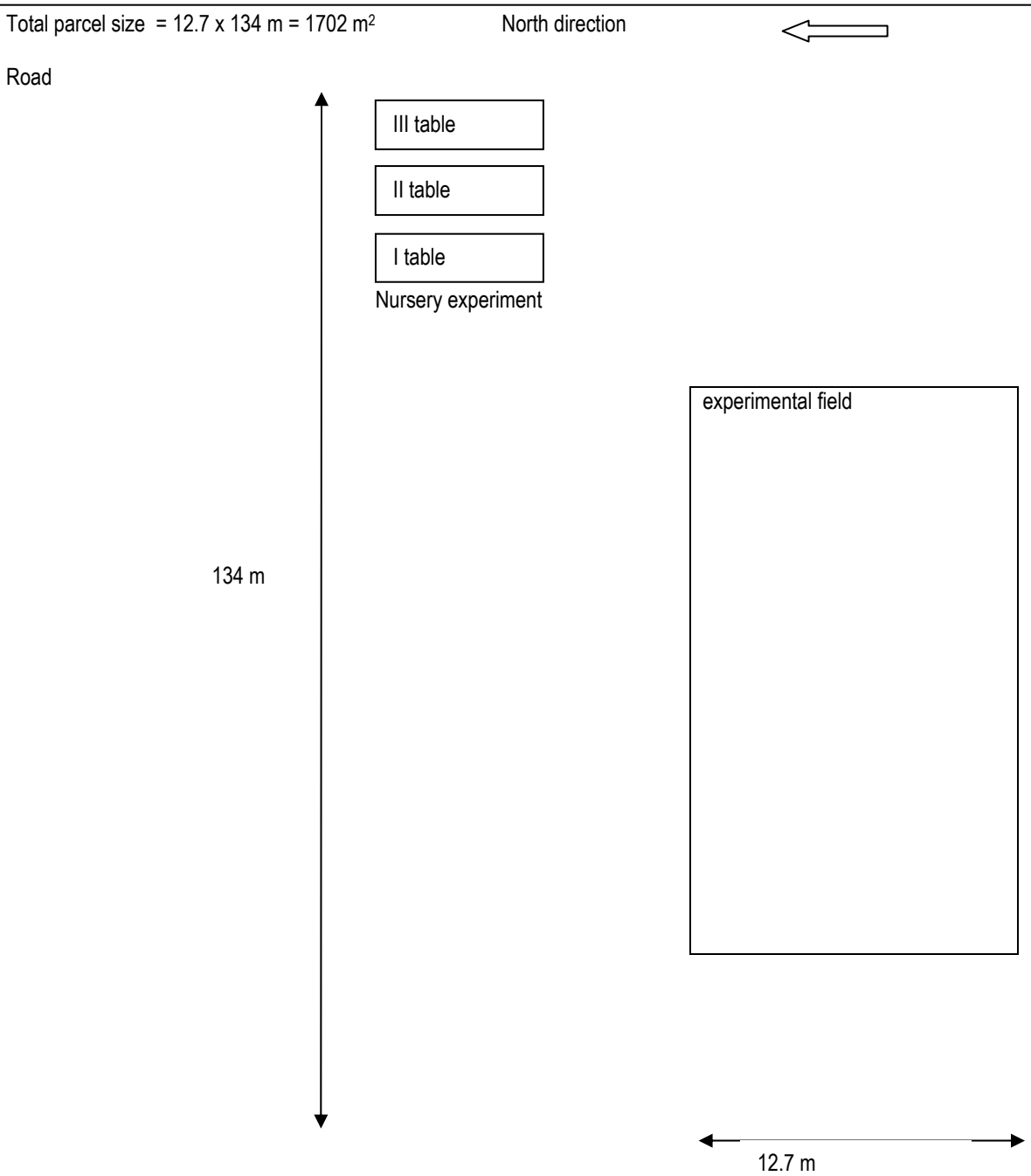

Figure 2. Layout of the experimental site.

2.1 Treatments in the experiment

Single treatments factors are presented in table 2. Two varieties, two types of containers and three field treatments: use of screen net, use of mulch and cropping system, were tested and compared with results of direct sowing.

Table 2. Single treatments factors.

Variety:	A1:	Tit Segitiga
	A2:	Gada EWS hybrid
System	B1:	Inter-cropping + seedling
	B2:	Inter-cropping + seedling + screen net
	B3:	Inter-cropping with seedling raised in plastic bags
	B4:	Mono-cropping + seedling (sowed 2 wk later than B1 and kept 1 wk longer in the nursery)
	B5:	Mono-cropping + seedling + screen net
	B6:	Mono-cropping + seedling + plastic mulch
	B7	Mono-cropping + seedling + screen net + plastic mulch
	B8:	Inter-cropping with direct sowing standard practice
	B9:	Mono-cropping with direct sowing immediately after shallot harvest

Not all treatments were combined and tabel 3 presents the tested treatments in the field.

Table 3. Treatment combination in the experiment.

	Code	Variety	Container	Media	Cultivation System
1	A1B1	Tit Segitiga	Plastic tray	Manure + top soil	Inter-cropping
2	A1B2	Tit Segitiga	Plastic tray	Manure + top soil	Inter-cropping + screen net
3	A1B3	Tit Segitiga	Plastic bag	Manure + top soil	Inter-cropping
4	A1B4	Tit Segitiga	Plastic tray	Manure + top soil	Mono-cropping
5	A1B5	Tit Segitiga	Plastic tray	Manure + top soil	Mono-cropping + screen net
6	A1B6	Tit Segitiga	Plastic tray	Manure + top soil	Mono-cropping + plastic mulch
7	A1B7	Tit Segitiga	Plastic tray	Manure + top soil	Mono-cropping + screen net + plastic mulch
8	A1B8	Tit Segitiga	Direct sowing		Inter-cropping
9	A1B9	Tit Segitiga	Direct sowing		Mono-cropping after a shallot cultivation
10	A2B1	Gada	Plastic tray	Manure + top soil	Inter-cropping
11	A2B2	Gada	Plastic tray	Manure + top soil	Inter-cropping + screen net
12	A2B3	Gada	Plastic bag	Manure + top soil	Inter-cropping
13	A2B4	Gada	Plastic tray	Manure + top soil	Mono-cropping
14	A2B5	Gada	Plastic tray	Manure + top soil	Mono-cropping + screen net
15	A2B6	Gada	Plastic tray	Manure + top soil	Mono-cropping + plastic mulch
16	A2B7	Gada	Plastic tray	Manure + top soil	Mono-cropping + screen net + plastic mulch
17	A2B8	Gada	Direct sowing		Inter-cropping
18	A2B9	Gada	Direct sowing		Mono-cropping

2.2 Nursery for raising of seedlings

For raising seedlings a simple nursery construction was used. (Figure 3 and 4). Bamboo was used for construction of the frame and for construction of the table to place the seedlings on. The frame was covered with screen net to have a closed area in which transplants or seedlings could be raised. The nursery house was present in three replications.

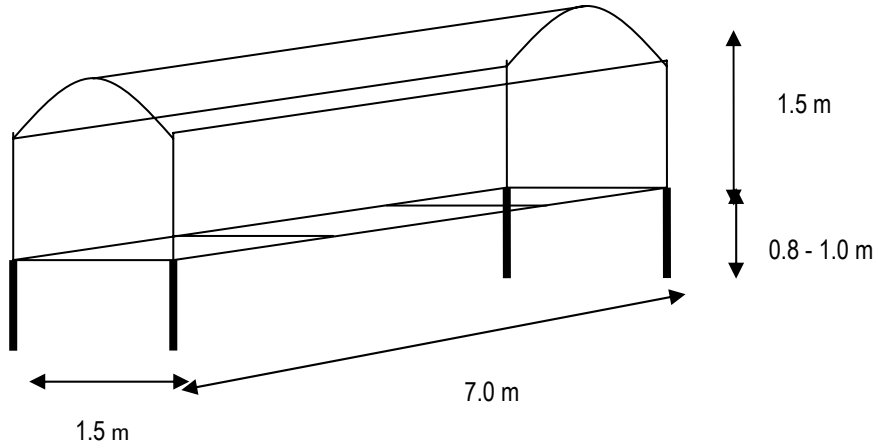

Figure 3. Schematic view of a table nursery.

Figure 4. Inside of a table nursery.

2.3 Hot pepper varieties used for the experiment

Two types of varieties were used in the experiments:

- Local open pollinated variety (Tit Segitiga)
- Hybrid variety (Gada F_1)

Seeds from Tit Segitiga were obtained locally from farmers while seeds from Gada F_1 were received from PT EWINDO located at Purwakarta.

2.4 Seedling raising treatments

For container, two types were tested namely a modular tray with 128 modules per tray and individual plastic bags (Fig. 8). At the 128 module tray the cell shape was pyramidal with a cell content of 13 cm^3. Plastic bags have a volume of 15 cm^3 and holes were punctured in the bottom to provide drainage.
Components for media were goat manure collected from nearby farms, and top soil collected from the field near to the nursery. Media was prepared by thoroughly mixing 1 volume part of manure with 1 volume part of top soil.

Figure 8. Plastic bags and modular tray with 128 cells, used for seedling raising of hot pepper.

2.5 Cultivation

2.5.1 Cropping system

Normally hot pepper is intercropped with shallot (Figure 5). In Brebes crops are grown on suats or beds surrounded by ditches. In the experiments each plot consisted of half a suat with a size of 1.5 x 5.7 m. Shallots were planted one day before hot pepper seeds were sown. Population density of hot pepper for the open pollinated variety was double compared to the density of the hybrid variety (Table 4). For transplanting, hot pepper seedlings were transplanted 4 to 5 weeks after shallot was planted.
With the monocropping treatments only hot pepper was planted or sowed at similar positions as with intercropping but shallot was not cultivated then.

Table 4. Number of plants per plot and planting distances for shallot and hot pepper.

	Plants per plot	Number of rows	Plants per row	Distance within a row	Distance between rows
Shallot	260	10	26	21	15
Hot pepper (OP)	100	4	25	21	30/60
Hot pepper (F_1)	50	4	13	42	30/60

Figure 5. One Suat or bed containing two experimental plots.

2.5.2 Mulching

Black plastic mulch of 1.5 m wide was applied to beds and afterwards holes were punched at the plant positions (Fig. 6).

Figure 6. Black plastic mulch.

2.5.3 Screen net covers

Screen net covers of 2 x 6 x 1.5 m (w x l x h) were constructed with bamboo and screen net (Fig. 7). The brand name of the used screen net was agro pro: type r12-c215trm2-73. Characteristics of the net were: 27% light intensity reduction, 37% IUV reduction, 73% wind speed reduction, 138 holes per cm^2, mesh/1" is 24x3, weight is 150 g/m^2.

Figure 7. Screen net covers in the field .

2.5.4 Cultivation practice

Sowing of hot pepper in the field and in the nurseries took place on 13 March 2009, March 26th and May 8th (Table 5). On March 26th only transplants for the mono crop cultivation of transplants was sowed (treatment B4), all other treatments were sowed on March 13. Sowing for the direct sowing treatment after shallot cultivation took place on May 8th , 2009. With Gada F1 per plot 128 and 130 seeds were sown for respectively the tray and plastic bag transplant raising treatments while with direct sowing 250 seeds were sowed. Respectively 200 and 500 seeds per plot were sown for transplant raising and direct sowing with Tit Segitiga. With direct sowing of both varieties 5 seeds per planting hole were sowed.
Shallot was planted in the field on March 12th and harvest took place on May 7th, 2009. Transplanting of seedlings raised in the nursery into the field took place on April 17th and April 24th, 2009. Transplants were planted until cotyledon depth.

Table 5. General information on the cultivation.

Hot pepper sowing	:	March 13, March 26 and May 8.
Hot pepper transplanting	:	April 17 and April 24
Shallot planting	:	March 12
Shallot harvest	:	May 7
Used seeds in nursery	:	128/ 130 (Gada) and 200 (Tit Segitiga) per plot
Direct sowing seed use	:	500 seeds per plot for Tit Segitiga
(5 seeds per sowing position)		250 seeds per plot for Gada
Plant density	:	Tit Segitiga at 12.2 plants per m^2
		Gada F_1 at 6.1 plants per m^2

Further cultivation, method of harvesting, amount of fertiliser and pest control of hot pepper took place as common farmers practice in Kersana Brebes.

2.6 Observations

2.6.1 Temperature and rainfall

During the experiment temperature was recorded by taking readings at 14.00 p.m. each day on maximum and minimum temperature. One thermometer was placed in one of the nurseries and one was placed outside in the field. From July 18 temperature was also recorded inside two screen net covers. All thermometers were placed in a shaded position. Rainfall data were gathered from Brebes Agricultural Office weather station and measured daily at 6.30 a.m. using a simple rain gauge. Data from the weather station based at Tegal, 20 km east of the field, were also collected. Data of all these recordings are listed in Annex IV.

2.6.2 Nutrient content

From the media used for filling the trays and plastic bags a sample was taken for analyse on nitrogen, potassium, phosphate, calcium and pH level. After preparing the media the sample was taken by taking 1 kg of prepared substrate.

2.6.3 Light intensity

During seedling raising, light intensity in Lux was measured with a handheld Lux meter (LX93 from Nieuwkoop) inside and outside the nurseries on February 15, February 29 and on March 13, 2009. Readings were taken at 8.00, 12.00 and 14.00 hour. At the last two observations a black paranet for shading was attached inside the nursery. Inside each nursery at two spots light intensity was measured and outside each nursery light intensity was measured at one spot (Annex II). Percentage available light inside the nurseries, was calculated based on these readings.
On July 28, August 11 and on September 1, light interception of the crops cultivated inside the screen net covers was measured. These treatments included intercropping with transplants, mono cropping with transplants and mono cropping with transplants with mulch. One reading was taken outside the screen net cover first. Then three readings were taken at the stem base, three at the middle part of the plant and three just above the plant.

2.6.4 Nursery observations

Emergence was observed 10, 20 and 30 days after sowing of the treatments. Percentage of normal and abnormal seedlings was calculated.
At transplanting number of normal, usable and abnormal transplants were observed and percentage was calculated as well. Also number of plants with virus symptoms and infected with thrips were observed. At transplanting randomly per plot 15 seedlings were selected, cut off at soil level, and measured for plant length, individual plant weight and number of fully developed leaves.
Plant length was measured from the cut off point to the end tip of a leave of a fully stretched out plant. After drying at 70^{o}C for 24 hours the total weight of the 15 plants together was weighed. Percentage dry weight was calculated as well.

2.6.5 Shallot harvest observations

Shallots were harvested on May 7 and marketable production in gram per plot was recorded.

2.6.6 Plant length and number of internodes

On July 16, plant length and number of internodes of 5 plants per treatment was observed. This was done only at the treatments intercropping, monocropping and monocropping with mulch, all cultivated with transplants inside screen net covers. Average internode length was calculated based on these observations. On September 29 the same observations were done again for the same treatments and for the direct sowing and intercropping treatment in the open field as well.

2.6.7 Hot pepper harvest observations

Fruits were harvested when mature, and harvesting took every two to five days place depending on the speed of fruit maturing.

At each harvest date, per plot the number and total weight of harvested fruits in gram was observed. After this fruits were graded in marketable fruits and unmarketable fruits. The number and weight of marketable fruits was then observed. At each harvest also the number of present plants per plot was observed.
Based on the observations, total fruit number and weight, marketable fruit number and weight per plant and per square meter cultivation surface was calculated. Also share of marketable weight in total yield and average fruit weight was calculated.

2.7 Statistical information

The experiment was carried out as a randomized block design in three replications (Annex II and III). Results were analysed with ANOVA (analysis of variance) by using the statistical program Genstat for Windows 11th edition.

3 Results

3.1 Climate

During transplant raising the maximum temperature inside the nurseries was from 27 March till 14 April 1 to 2 degrees higher than the open field temperature (Fig. 9). The first 10 days and the last 10 days the thermometer that recorded the maximum temperature in the nursery did not function properly. Minimum temperature inside the nursery was quite similar to the open field temperature. Open field maximum temperature was during the first two weeks about 40°C and the minimum temperature was 24°C.

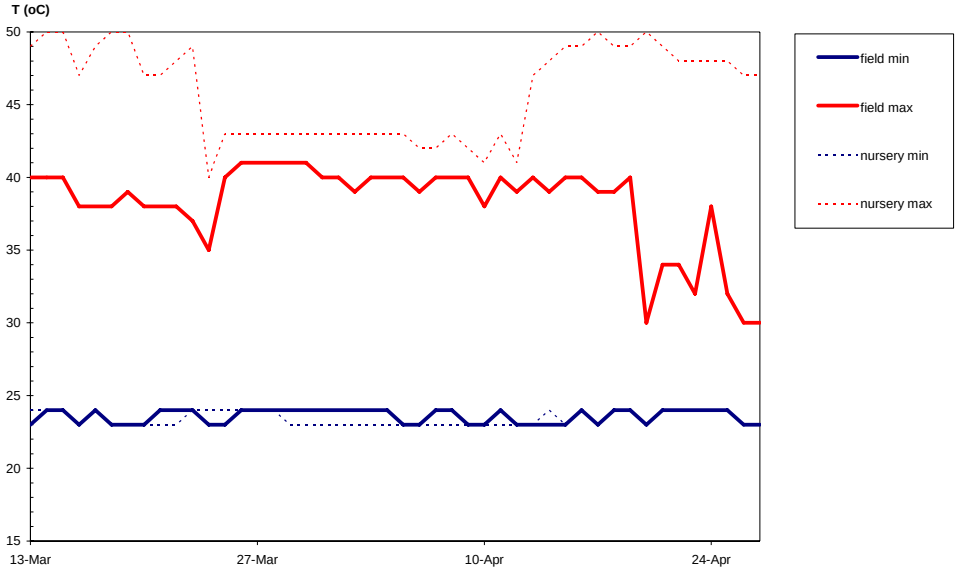

Figure 9. Inside nursery and open field maximum and minimum temperature during transplant raising.

The official weather records of Tegal showed that maximum temperature was between 30 and 35°C during the experiment (Fig. 10). Minimum temperature ranged between 20 and 25°C. Total precipitation or rainfall during the experiment was 410 mm.

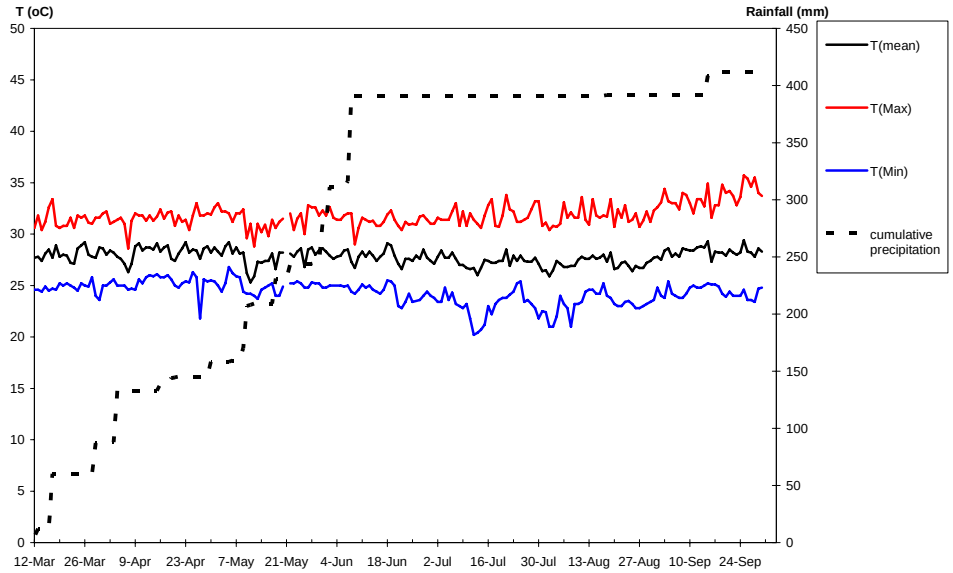

Figure 10. Rainfall, maximum and minimum temperature recorded at the Tegal weather station.

3.2 Light levels

On February 15 the reduction in light inside the nurseries by the screen net was 21% of the available outdoor light intensity (Table 7). On February 26 and March 13 where black paranet was hung up inside the nurseries to gave more shade to the seedlings the reduction in light was respectively 57 and 42%.

Table7. Light level reduction (%) of outdoor light conditions.

	February 15	February 26 (with shading net)	March 13 (with shading net)
Light level reduction	21	57	42

3.3 Nutrient content of media

The used media in this experiment was the combination of top soil with manure (TS+M) (Table 8). The pH of this media is slightly alkaline with a pH-H_2O of 6.9, in standard ready available potting soils for vegetable seedling production a pH of 5.6 to 6.0 is advisable. Total nitrogen content is about 0.3 % or 300 mg per 100 gram media. N-min content of the substrate used in the experiments is 93.7 mg/kg media or 0.15 kg/m^3 based on fresh weight of the media. For transplant raising a nitrate and ammonium content of 8 – 9.5 mmol per litre is recommended by the Dutch society RHP.

Table 8. Bulk density and nutrient content of media/substrate samples taken in February 2009.

Media	kg/l	pH-H_2O	pH-KCl	N (%)	N-min (ppm)	P_2O_5 (%)	K_2O (%)	CaO (%)	MgO (%)
Rice husk (RH)	0.6	6.9	6.0	0.43	93.5	0.24	0.14	0.12	0.07
Manure (M)	0.7	8.6	8.4	0.38	52.9	0.86	1.48	2.85	1.19
Top soil (TS)	1.4	6.9	5.9	0.28	2.9	0.16	0.42	1.13	0.04
RH + M	0.7	8.4	8.2	0.48	93.7	0.66	1.39	2.18	0.86
TS + M	0.8	8.1	7.8	0.33	61.6	0.42	0.96	2.00	1.02
RH + M + TS	0.8	8.1	7.7	0.39	37.9	0.53	0.98	1.92	1.12

3.4 Nursery results

Percentage of emerged seedlings after 10 days was with direct sowing the highest (Table 9). Direct sowing after shallot cultivation showed a higher emergence than emergence where direct sowing took place with shallot intercropping. The tray raising treatment intended for using with monocropping, which was sowed at a later date then the other tray and plastic bag treatments, showed a significant higher emergence than the other tray raising treatments. All other tray transplant raising treatments showed similar results during the nursery phase. Gada did not show a different emergence than present with Tit Segitiga.

Table 9. Emerged seedlings 10 days after sowing (%).

	variety		
system	Gada	Tit Segitiga	Mean
Direct sowing with intercropping	38.8	40.9	39.9
Tray Transplant (used for Intercropping)	0.3	0.2	0.2
Bag Transplant (used for intercropping)	5.9	2.8	4.4
Tray Transplant (used for intercropping+screen net	0.0	0.7	0.3
Direct sowing with monocropping after shallot is harvested	85.5	77.3	81.4
Tray Transplant (used for monocropping)	38.5	45.5	42.0
Tray Transplant (used for monocropping+mulch)	8.1	0.3	4.2
Tray Transplant (used for monocropping+screen net)	1.0	2.8	1.9
Tray Transplant (used for monocropping+screen net+mulch)	2.1	0.3	1.2
Mean	20.0	19.0	19.5
	Variety (V)	System (S)	V * S
LSD	3.8	8.0	11.3
p =	0.6	<0.001	0.6

After 20 days emergence of direct sowing with intercropping was not higher than the emergence of the transplant raising treatments (Table 10). Direct sowing with monocropping showed a higher emergence after 20 days compared to direct sowing with intercropping and to tray and plastic bag transplant raising treatments. Gada showed a slightly lower emergence than Tit Segitiga, but only for the tray transplant to be used for intercropping, for the tray transplant for intercropping with screen net and for the tray transplant for monocropping with screen net.

Table 10. Emerged seedlings 20 days after sowing (%).

	variety		
system	Gada	Tit Segitiga	Mean
Direct sowing with intercropping	40.9	44.9	42.9
Tray Transplant (used for Intercropping)	24.0	55.0	39.5
Bag Transplant (used for intercropping)	70.3	60.8	65.5
Tray Transplant (used for intercropping+screen net	39.3	62.3	50.8
Direct sowing with monocropping after shallot is harvested	85.9	77.9	81.9
Tray Transplant (used for monocropping)	62.0	68.2	65.1
Tray Transplant (used for monocropping+mulch)	47.7	60.2	53.9
Tray Transplant (used for monocropping+screen net)	40.6	58.7	49.6
Tray Transplant (used for monocropping+screen net+mulch)	45.1	56.2	50.6
Mean	50.6	60.5	55.5
	Variety (V)	System (S)	V * S
LSD	6.1	13.0	18.4
p =	0.002	<0.001	0.05

At transplanting stage the percentage of usable seedlings with direct sowing with intercropping was significant lower than the percentage present with all other treatments (Table 11). With direct sowing after shallot harvest, a significant higher percentage of usable seedlings was present compared to direct sowing with intercropping. A higher percentage of usable seedlings was present with raising in plastic bags compared to most tray transplant

raising treatments. Only tray transplants to be used for monocropping treatment showed a similar percentage than with raising in plastic bags.
Between variety no differences in percentage of usable seedlings were present.

Table 11. Usable seedlings at transplanting (%).

		variety		
system		Gada	Tit Segitiga	Mean
Direct sowing with intercropping		48.1	50.7	49.4
Tray Transplant (used for Intercropping)		59.4	68.7	64.0
Bag Transplant (used for intercropping)		85.1	83.7	84.4
Tray Transplant (used for intercropping+screen net		64.6	76.8	70.7
Direct sowing with monocropping after shallot is harvested		85.1	76.1	80.6
Tray Transplant (used for monocropping)		79.2	83.5	81.3
Tray Transplant (used for monocropping+mulch)		72.7	74.2	73.4
Tray Transplant (used for monocropping+screen net)		64.3	71.8	68.1
Tray Transplant (used for monocropping+screen net+mulch)		64.8	69.2	67.0
Mean		69.3	72.7	71.0
		Variety (V)	System (S)	V * S
	LSD	4.7	10.1	14.2
	p =	0.1	<0.001	0.6

Fresh weight of seedlings with direct sowing and monocropping was the highest (Table 12). Seedlings raised in plastic bags showed a similar fresh weight, while other treatments showed a lower fresh weight than present with direct sowing. Seedlings of direct sowing with intercropping showed a fresh weight that was about 4.5 g lighter than the fresh weight at direct sowing with monocropping . Tray transplants for monocropping showed a similar or higher fresh weight than the other tray transplant treatments.

Table 12. Fresh weight (g) of seedlings at transplanting.

		variety		
system		Gada	Tit Segitiga	Mean
Direct sowing with intercropping		13.9	15.6	14.8
Tray Transplant (used for Intercropping)		5.4	5.9	5.6
Bag Transplant (used for intercropping)		19.3	19.4	19.4
Tray Transplant (used for intercropping+screen net		5.8	9.5	7.6
Direct sowing with monocropping after shallot is harvested		23.1	15.8	19.4
Tray Transplant (used for monocropping)		10.6	9.7	10.2
Tray Transplant (used for monocropping+mulch)		10.3	10.1	10.2
Tray Transplant (used for monocropping+screen net)		11.1	8.5	9.8
Tray Transplant (used for monocropping+screen net+mulch)		7.7	6.0	6.9
Mean		11.9	11.2	11.5
		Variety (V)	System (S)	V * S
	LSD	1.5	3.2	4.5
	p =	0.3	<0.001	0.09

Dry weight of direct sowing with intercropping was not significant different from the dry weight of direct sowing with moncropping. Also the dry weight of seedlings raised in plastic bags and in trays to be used for monocropping and for monocropping with mulch did not differ from the dry weight of direct sowing with monocropping. Dry weight of plastic bag seedlings was significant higher than the dry weight present at the other tray transplants. Dry weight of tray transplants did not differ significantly from the dry weight observed at direct sowing with intercropping, all sowed at a same time.

Table 13. Dry weight (g) of 15 seedlings at transplanting.

	variety		
system	Gada	Tit Segitiga	Mean
Direct sowing with intercropping	2.1	2.1	2.1
Tray Transplant (used for Intercropping)	0.7	0.7	0.7
Bag Transplant (used for intercropping)	2.9	2.5	2.7
Tray Transplant (used for intercropping+screen net	0.7	1.4	1.0
Direct sowing with monocropping after shallot is harvested	2.9	2.0	2.4
Tray Transplant (used for monocropping)	4.4	1.4	2.9
Tray Transplant (used for monocropping+mulch)	1.5	1.5	1.5
Tray Transplant (used for monocropping+screen net)	1.3	1.1	1.2
Tray Transplant (used for monocropping+screen net+mulch)	1.0	0.8	0.9
Mean	1.9	1.5	1.7
	Variety (V)	System (S)	V * S
LSD	0.7	1.4	2.0
p =	0.2	0.01	0.3

Plant length of seedlings raised in plastic bags was longer than the length present at all other treatments (Table 14). Direct sowing and monocropping showed taller seedlings than present at direct sowing with intercropping. Seedlings with direct sowing and intercropping showed a longer plant length than the length present at four of the six tray transplant treatments. Length of tray transplants used for monocropping did not show a different length than the length present at seedlings with direct sowing and intercropping.

Table 14. Plant length (cm) of seedlings at transplanting.

	variety		
system	Gada	Tit Segitiga	Mean
Direct sowing with intercropping	9.7	11.3	10.5
Tray Transplant (used for Intercropping)	7.0	8.0	7.5
Bag Transplant (used for intercropping)	15.1	16.4	15.8
Tray Transplant (used for intercropping+screen net	5.5	8.9	7.2
Direct sowing with monocropping after shallot is harvested	13.5	11.0	12.2
Tray Transplant (used for monocropping)	10.6	9.7	10.2
Tray Transplant (used for monocropping+mulch)	10.3	6.9	8.6
Tray Transplant (used for monocropping+screen net)	7.7	7.5	7.6
Tray Transplant (used for monocropping+screen net+mulch)	6.0	6.7	6.4
Mean	9.5	9.6	9.5
	Variety (V)	System (S)	V * S
LSD	0.8	1.8	2.5
p =	0.8	<0.001	0.015

Number of leaves at transplanting was on average 8.6 (Table 16). Direct sowing showed a higher number of leaves compared to transplants. Only at the tray transplant treatment for intercropping and screen net Gada showed a lower number of leaves. At all other treatments number of leaves was for both varieties the same.
Transplants raised in bags showed a significant higher number of leaves than transplants raised in trays. No significant difference was present between transplants raised in bags or with direct sowing.

Table 16. Average number of leaves per seedlings at transplanting.

	variety		
system	Gada	Tit Segitiga	Mean
Direct sowing with intercropping	10.5	10.6	10.5
Tray Transplant (used for Intercropping)	7.3	6.3	6.8
Bag Transplant (used for intercropping)	10.2	9.9	10.1
Tray Transplant (used for intercropping+screen net	6.8	8.1	7.5
Direct sowing with mono cropping after shallot is harvested	11.9	10.7	11.3
Tray Transplant (used for monocropping)	8.4	8.2	8.3
Tray Transplant (used for monocropping+mulch)	9.1	7.1	8.1
Tray Transplant (used for monocropping+screen net)	8.1	7.5	7.8
Tray Transplant (used for monocropping+screen net+mulch)	7.0	7.1	7.1
Mean	8.8	8.4	8.6
	Variety (V)	System (S)	V * S
LSD	0.4	0.9	1.3
p =	0.07	<0.001	0.05

A higher percentage of Tit Segitiga seedlings were showing virus symptoms than Gada seedlings did (Table 17). On average 1.1% of the seedlings were showing virus symptoms. Transplants for monocropping, screen net and mulch treatment showed 2.5% while transplants for monocropping alone showed 0 %.
Direct sowing with monocropping showed 2.2 % and direct sowing with intercropping showed a significant lower percentage at a same plant age.

Table 17. Seedlings at transplanting infected with virus (%).

	variety		
system	Gada	Tit Segitiga	Mean
Direct sowing with intercropping	0.1	0.1	0.1
Tray Transplant (used for Intercropping)	1.3	1.0	1.2
Bag Transplant (used for intercropping)	0.0	1.3	0.7
Tray Transplant (used for intercropping+screen net	1.0	0.5	0.8
Direct sowing with mono cropping after shallot is harvested	1.6	2.8	2.2
Tray Transplant (used for monocropping)	0.0	0.0	0.0
Tray Transplant (used for monocropping+mulch)	0.8	1.8	1.3
Tray Transplant (used for monocropping+screen net)	0.3	2.8	1.5
Tray Transplant (used for monocropping+screen net+mulch)	2.6	2.3	2.5
Mean	0.9	1.4	1.1
	Variety (V)	System (S)	V * S
LSD	0.6	1.2	1.7
p =	0.06	0.002	0.2

Percentage of seedlings with thrips symptoms was the highest at direct sowing and intercropping followed by direct sowing of Gada (Table 18). With Tit Segitiga the highest thrips incidence was present with direct sowing and monocropping. Tit Segitiga transplants showed a significant lower percentage of seedlings with thrips symptoms than direct sowing and monocropping, but was not different from direct sowing and intercropping. With Gada all transplant raising treatments showed a lower percentage compared to direct sowing and intercropping but not compared to direct sowing and monocropping. A higher percentage of seedlings with thrips symptoms was present with direct sowing and intercropping at Gada compared to Tit Segitiga. With direct sowing and monocropping Tit Segitiga showed a higher incidence than present with Gada.

Table 18. Seedlings at transplanting with thrips incidence (%).

	variety		
system	Gada	Tit Segitiga	Mean
Direct sowing with intercropping	6.3	2.0	4.1
Tray Transplant (used for Intercropping)	0.3	1.2	0.7
Bag Transplant (used for intercropping)	1.8	1.5	1.6
Tray Transplant (used for intercropping+screen net	0.8	0.5	0.6
Direct sowing with mono cropping after shallot is harvested	2.1	4.5	3.3
Tray Transplant (used for monocropping)	1.0	1.2	1.1
Tray Transplant (used for monocropping+mulch)	2.9	0.8	1.8
Tray Transplant (used for monocropping+screen net)	1.0	1.2	1.1
Tray Transplant (used for monocropping+screen net+mulch)	1.0	1.0	1.0
Mean	1.9	1.5	1.7
	Variety (V)	System (S)	V * S
LSD	0.7	1.5	2.1
p =	0.3	<0.001	0.008

3.5 Shallot production

Average shallot yield was 0.68 kg per square meter or 6.8 ton per ha(Table 19). No significant differences were present in shallot yield between cultivation together with Gada or with Tit Segitiga hot pepper. With the different hot pepper treatments no differences in shallot yield were observed.

Table 19. Yield of shallots cultivated as an intercrop with hot pepper (kg/m2)

	Variety		
system	Gada	Tit Segitiga	mean
Intercropping + Bag Transplant	1.04	1.36	1.20
Intercropping + Direct Sowing	1.19	1.24	1.21
Intercropping + Tray Transplant	1.36	1.21	1.28
Intercropping + Tray Transplant + Screen net	1.09	1.19	1.14
Monocropping + Direct Sowing (After Shallot is harvested)	1.38	1.21	1.30
Monocropping + Tray Transplant	-	-	-
Monocropping + Tray Transplant + Screen net	-	-	-
Monocropping + Tray Transplant+ Screen net + Mulch	-	-	-
Monocropping + Tray Transplant+ Mulch	-	-	-
mean	0.67	0.69	0.68
	Variety (V)	System (S)	V * S
LSD	0.1	0.2	0.3
p =	0.6	0.5	0.1

3.6 Plant length and light interception

Light interception by Tit Segitiga was almost significant higher than the light interception by Gada (Table20). Maximum light interception by the crop was 61.7 % f the total available light for plant light interception with Tit Segitiga grown as a monocrop with mulch. Between treatments no significant differences were present.

Table 20. Light interception of crops cultivated in the screen net covers (%).

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Tray Transplant + Screen net		57.6	56.9	57.3
Monocropping + Tray Transplant + Screen net		50.8	54.1	52.5
Monocropping + Tray Transplant+ Screen net + Mulch		48.2	61.7	55.0
Mean		52.2	57.6	
		Variety (V)	System (S)	V * S
	LSD	5.7	7.0	9.9
	p =	0.07	0.4	0.1

Plants of Tit Segitiga were taller than Gada plants (Table 21). On average Tit Segitiga was 9 cm higher than Gada. Plants grown as an intercrop were on average taller than plants grown as a monocrop. Plants with mulch did not show a significant different plant length than plants grown without mulch.

Table 21. Plant length (cm) of crops cultivated in the screen net covers observed on July 16.

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Tray Transplant + Screen net		129	135	132
Monocropping + Tray Transplant + Screen net		118	126	122
Monocropping + Tray Transplant+ Screen net + Mulch		117	130	124
Mean		121	130	
		Variety (V)	System (S)	V * S
	LSD	7.6	9.3	13.2
	p =	0.02	0.06	0.7

Gada showed more internodes per plant than Tit Segitiga, but this difference was not significant (Table 22). Plants grown on mulch showed a lower internode number than plants grown without mulch. Between intercrop and monocrop both grown without mulch no difference in internode number was present.

Table 22. Number of Internodes of crops cultivated in the screen net covers observed on July 16.

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Tray Transplant + Screen net		17.4	16.1	16.8
Monocropping + Tray Transplant + Screen net		16.1	16.3	16.2
Monocropping + Tray Transplant+ Screen net + Mulch		15.4	15.1	15.2
Mean		16.3	15.8	
		Variety (V)	System (S)	V * S
	LSD	0.7	0.9	1.2
	p =	0.2	0.003	0.2

Tit Segitiga showed a longer internode length than Gada plants (Table 23). Average internode length with Tit Segitiga was 8.3 cm while Gada internode length was 7.5 cm. Between treatments no difference in internode length was present.

Table 23. Mean internode length (cm) of crops cultivated in the screen net covers observed on July 16.

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Tray Transplant + Screen net		7.4	8.4	7.9
Monocropping + Tray Transplant + Screen net		7.4	7.7	7.5
Monocropping + Tray Transplant+ Screen net + Mulch		7.8	8.7	8.2
Mean		7.5	8.3	
		Variety (V)	System (S)	V * S
	LSD	0.5	0.7	0.9
	p =	0.007	0.1	0.6

Plant length of Gada was on average 115 cm on September 29th, and was significant shorter than the length of Tit Segitiga (Table 24). Transplants with intercropping cultivated in the open field showed a taller plant length than transplants cultivated inside the insect. Plants grown as a monocrop inside the screen net showed a shorter length than the plants grown as a intercrop. Direct sowing showed an almost significant shorter plant length than transplants in the open field.

Table 24. Plant length (cm) of crops cultivated in the screen net covers and of direct sowing with intercrop and tray transplant with intercrop observed on September 29.

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing		101	118	110
Intercropping + Tray Transplant		109	129	119
Intercropping + Tray Transplant + Screen net		134	145	140
Monocropping + Tray Transplant + Screen net		116	130	123
Monocropping + Tray Transplant+ Screen net + Mulch		113	122	117
Mean		115	129	
		Variety (V)	System (S)	V * S
	LSD	6.3	9.9	14.0
	p =	<0.001	<0.001	0.8

No difference in number of internodes was present between variety (Table 25). Plants in the open field showed a significant higher number than plants grown inside the screen net. Between the different systems grown inside the screen net no significant difference in internode number was present. Although plants from transplants showed a higher number, also in the open field no difference between direct sowing or transplant was present,

Table 25. Number of internodes of crops cultivated in the screen net covers and of direct sowing with intercrop and tray transplant with intercrop observed on September 29.

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing		21.3	21.9	21.6
Intercropping + Tray Transplant		23.3	22.5	22.9
Intercropping + Tray Transplant + Screen net		15.7	16.3	16.0
Monocropping + Tray Transplant + Screen net		16.2	16.1	16.2
Monocropping + Tray Transplant+ Screen net + Mulch		15.9	16.5	16.2
Mean		18.5	18.6	
		Variety (V)	System (S)	V * S
	LSD	0.9	1.5	2.1
	p =	0.8	<0.001	0.8

Mean internode length of Tit Segitiga was longer than the length with Gada (Table 26). In the open field the internode length was shorter than the length present with plants grown inside the screen net covers. Between direct sowing and transplants no difference in internode length was present. Plants cultivated as an intercrop

inside the screen net cover showed a longer internode length than crops grown as a monocrop. Plants grown with mulch did not show a different internode length compared to the crop without mulch.

Table 26. Mean internode length (cm) of crops cultivated in the screen net covers and of direct sowing with intercrop and tray transplant with intercrop observed on September 29.

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing		4.8	5.4	5.1
Intercropping + Tray Transplant		4.7	5.7	5.2
Intercropping + Tray Transplant + Screen net		8.6	9.0	8.8
Monocropping + Tray Transplant + Screen net		7.1	8.0	7.6
Monocropping + Tray Transplant+ Screen net + Mulch		7.1	7.4	7.3
Mean		6.4	7.1	
		Variety (V)	System (S)	V * S
	LSD	0.4	0.6	0.9
	p =	0.002	<0.001	0.7

3.7 Hot pepper yield results

Gada showed a two time higher yield per plant than Tit Segitiga (Table 27). With Tit Segitiga no differences between open field cultivation systems were present. With Gada both monocropping with direct sowing and monocropping with transplants showed a lower yield per plant than the intercropping treatments and monocropping with mulch. Cultivation in screen net cover showed a higher yield per plant compared to open field cultivation. With Gada the intercropping cultivation showed a higher yield than the monocropping cultivation. With monocropping no difference between cultivation with or without mulch was present. With Tit Segitiga intercropping showed a higher yield per plant compared to the monocropping without mulch. With mulch showed a higher yield per plant which was not significant different from monocropping without mulch.

Table 27. Total yield per plant (g).

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing		134	47	90
Intercropping + Tray Transplant		133	55	94
Intercropping + Bag Transplant		133	56	95
Intercropping + Tray Transplant + Screen net		441	228	334
Monocropping + Direct Sowing (After Shallot is harvested)		6	2	4
Monocropping + Tray Transplant		28	25	26
Monocropping + Tray Transplant+ Mulch		142	52	97
Monocropping + Tray Transplant + Screen net		337	151	244
Monocropping + Tray Transplant+ Screen net + Mulch		379	178	278
Mean		193	88	
		Variety (V)	System (S)	V * S
	LSD	15.6	33.1	46.9
	p =	< 0.001	<0.001	<0.001

Marketable yield of Gada was on average 161 g per plant and significant higher than the yield per plant of Tit Segitiga (Table 28). Open field cultivation of Tit Segitiga did not show differences between cultivation systems. With Gada the monocopping with direct sowing and with transplants showed a lowed yield per plant than the systems with intercropping. With cultivation under screen net cover the intercropping system showed a significant higher yield than the monocropping systems of Gada. With mulch no higher yield was present to the same monocropping system but without mulch.

Table 28. Marketable yield per plant (g).

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing		74	16	45
Intercropping + Tray Transplant		71	27	49
Intercropping + Bag Transplant		73	28	51
Intercropping + Tray Transplant + Screen net		433	217	325
Monocropping + Direct Sowing (After Shallot is harvested)		5	1	3
Monocropping + Tray Transplant		24	23	23
Monocropping + Tray Transplant+ Mulch		76	21	49
Monocropping + Tray Transplant + Screen net		325	150	238
Monocropping + Tray Transplant+ Screen net + Mulch		366	176	271
Mean		161	73	
		Variety (V)	System (S)	V * S
	LSD	15.8	33.4	47.3
	p =	<0.001	<0.001	<0.001

Yield per square meter was the same for both Gada and Tit Segitiga (Table 29). Monocropping with direct sowing and with transplants showed a lower yield than the other systems. No differences were present between intercropping systems in the open field. Yield of transplants was 100 g more than with direct sowing but not significant different.

Table 29. Total yield per square meter (g).

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing		778	545	662
Intercropping + Tray Transplant		774	631	702
Intercropping + Bag Transplant		774	654	714
Intercropping + Tray Transplant + Screen net		2562	2648	2605
Monocropping + Direct Sowing (After Shallot is harvested)		37	18	28
Monocropping + Tray Transplant		163	286	224
Monocropping + Tray Transplant+ Mulch		808	596	702
Monocropping + Tray Transplant + Screen net		1963	1759	1861
Monocropping + Tray Transplant+ Screen net + Mulch		2163	2038	2101
Mean		1113	1019	
		Variety (V)	System (S)	V * S
	LSD	114.7	243.3	344.1
	p =	0.1	<0.001	0.8

No significant difference in marketable yield per square meter was present between Gada and Tit Segitiga (Table 30). The highest yield was present with intercropping of hot pepper transplants cultivated under screen net. Yield of the monocropping treatments cultivated under screen net were significant lower than the yield of the intercropping system. Both in the open field and under screen net, between cultivation with or without mulch no difference was present in yield. Monocropping with direct showing shoed the lowest yield and was significant different from the yield present at the intercrop cultivation systems in the open field. Between direct sowing and transplant use with intercropping no significant difference in yield was present.

Table 30. Marketable yield per square meter (g).

system		variety: Gada	variety: Tit Segitiga	Mean
Intercropping + Direct Sowing		428	188	308
Intercropping + Tray Transplant		414	315	365
Intercropping + Bag Transplant		425	331	378
Intercropping + Tray Transplant + Screen net		2517	2522	2519
Monocropping + Direct Sowing (After Shallot is harvested)		27	16	22
Monocropping + Tray Transplant		138	263	201
Monocropping + Tray Transplant+ Mulch		436	236	336
Monocropping + Tray Transplant + Screen net		1892	1752	1822
Monocropping + Tray Transplant+ Screen net + Mulch		2088	2020	2054
Mean		930	849	
		Variety (V)	System (S)	V * S
	LSD	123.7	262.5	371.2
	p =	0.2	<0.001	0.9

With Gada it seemed that production of marketable hot peppers started on June 19, while the production of transplants started 10 days later (Fig. 11). After that the production of transplants and direct sowing followed a similar pattern. With Tit Segitiga production of marketable fruits started for all treatments at a same data. Transplants raised in plastic bags or in trays followed a similar pattern in production. Increase in marketable production lasted until the end of July after which the increase in production slowly declined. With direct sowing the decline in production took also place at a same date, but in the previous period less product per harvest was harvested compared to transplants.

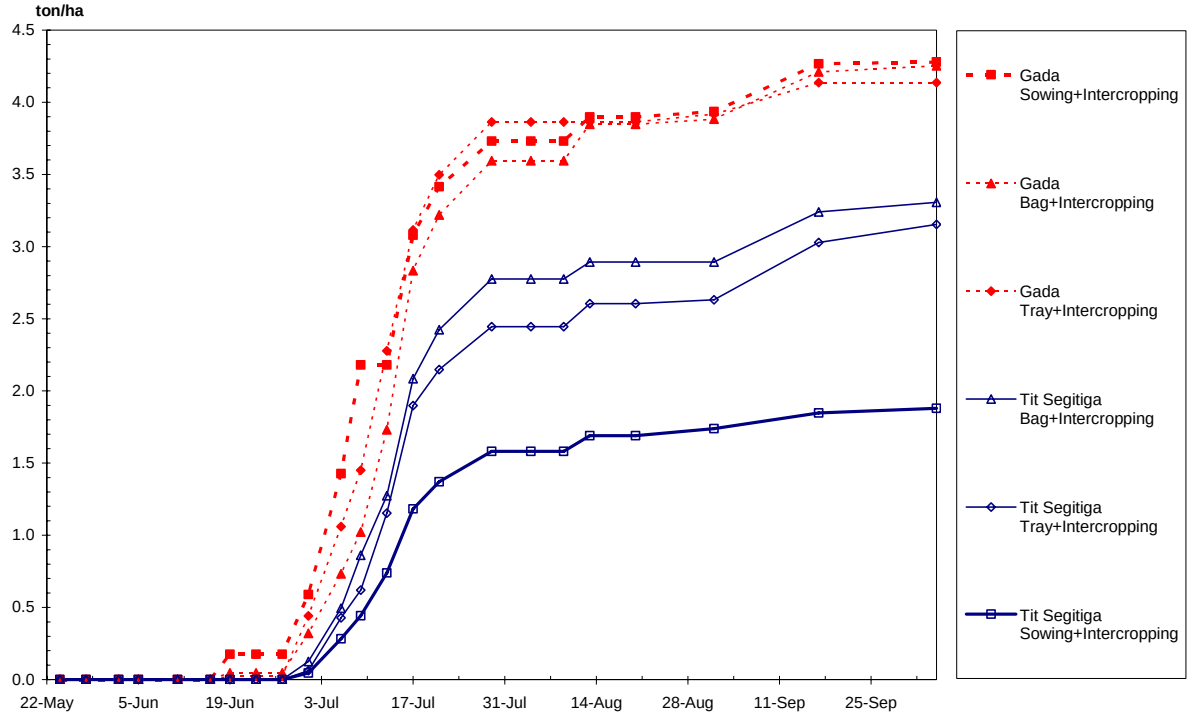

Figure 11. Cumulative marketable yield of direct sowing and transplants of Tit Segitiga and Gada (ton/ha).

With cultivation in screen net covers production of marketable product continued until the end of the crop (Fig. 12). With cultivation under screen net a stagnation in production was present in the period from August 14 till August 31 after which an increase in production could be seen again. Compared to the production in the open field where production almost ceased after July 31 the harvest period under screen net cover was two months longer.

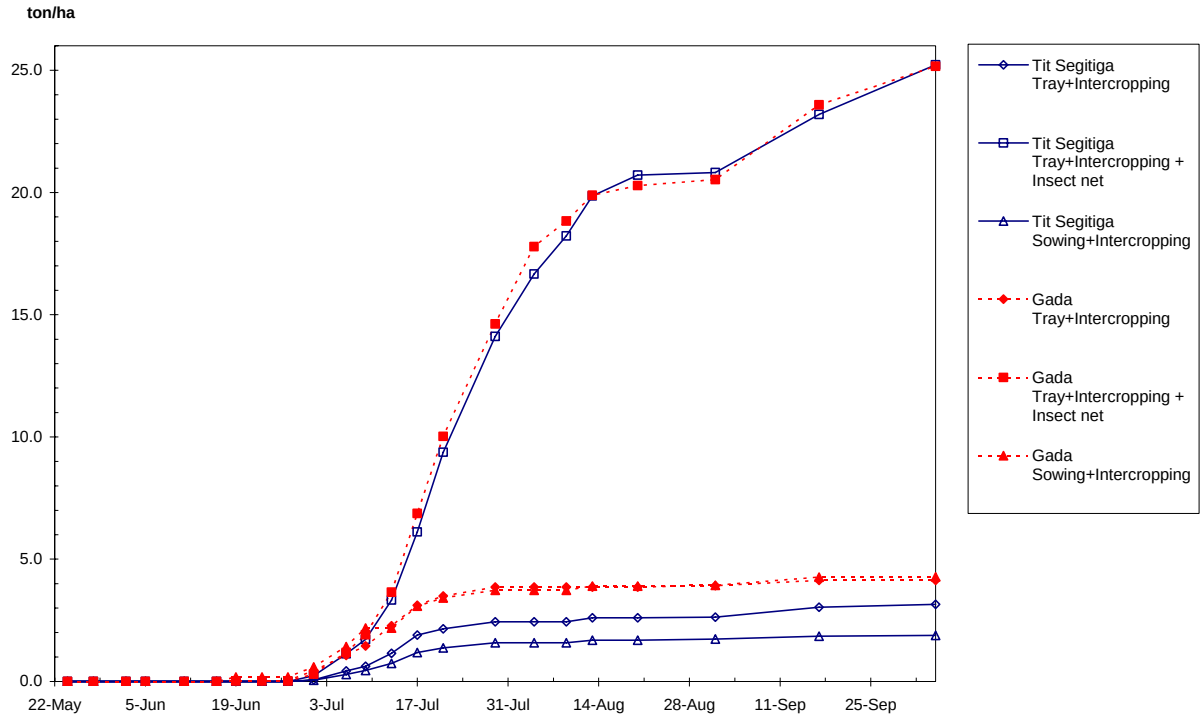

Figure 12. *Cumulative marketable yield of open field cultivation and cultivation in screen net covers of Tit Segitiga and Gada (ton/ha).*

Tit Segitiga showed for all screen net treatments a similar pattern in increase of marketable production (Fig. 13). With monocropping however, per harvest date less product was harvested compared to intercropping.

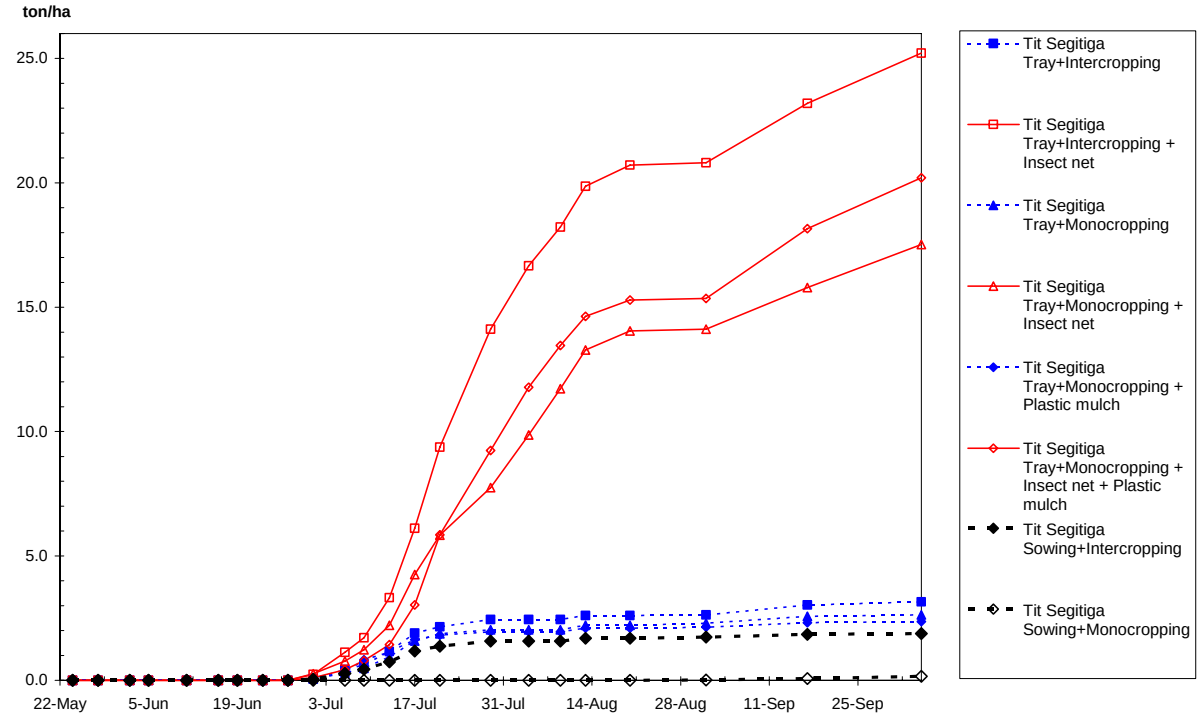

Figure 13. *Cumulative marketable yield of mono- and intercropping and with and without mulch of Tit Segitiga (ton/ha).*

With Gada a similar patterns as was present with Tit Segitiga was present in cumulative marketable production (Fig. 14).

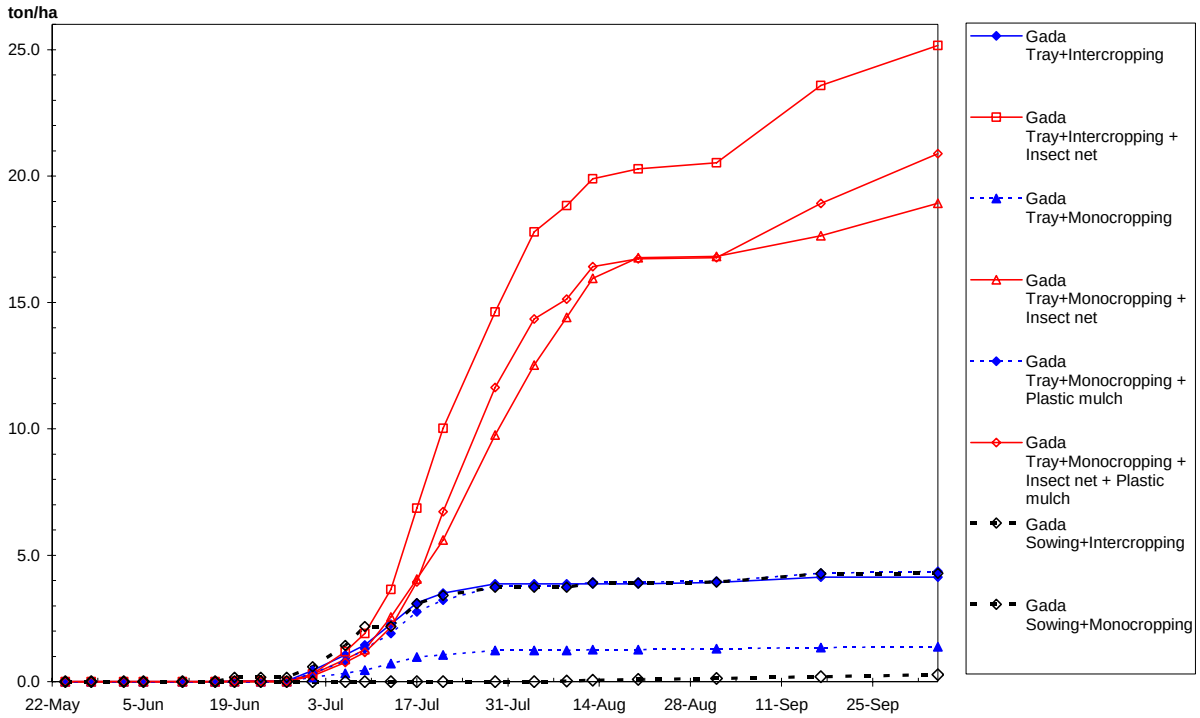

Figure 14. Cumulative marketable yield of mono- and intercropping and with and without mulch of Gada (ton/ha).

Marketable production of both varieties was in the open field 33 to 91% of the total production (Table 31). No difference between varieties was present. On average a percentage of 44% was present with direct sowing and intercropping. With the exception of monocropping and direct sowing and with transplants all other treatments in the open field did not show a different percentage compared to direct sowing. A high percentage of marketable production was present with monocropping and direct sowing and with transplants. However, the total production of these treatments was very low. The treatments under screen net cover showed a significant higher percentage of marketable production than the intercropping treatments and monocropping with mulch in the open field.

Table 31. Share of marketable yield in the total production (%).

	variety		
system	Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing	54	33	44
Intercropping + Tray Transplant	53	48	51
Intercropping + Bag Transplant	54	51	52
Intercropping + Tray Transplant + Screen net	98	95	97
Monocropping + Direct Sowing (After Shallot is harvested)	72	91	82
Monocropping + Tray Transplant	86	92	87
Monocropping + Tray Transplant+ Mulch	54	39	47
Monocropping + Tray Transplant + Screen net	96	99	98
Monocropping + Tray Transplant+ Screen net + Mulch	97	99	98
Mean	74	72	
	Variety (V)	System (S)	V * S
LSD	3.7	7.9	11.1
p =	0.3	<0.001	0.001

With direct sowing of Gada cultivated as an intercrop on average 17 fruits per plant were harvested while with Tit Segitiga 6 fruits were harvested (Table 32). With Tit Segitiga the number of harvested fruits was not significant different between the treatments cultivated in the open field. With Gada the monocropping treatments with direct sowing and with transplants showed a lower number than the other open field treatments. Both varieties showed

a significant higher fruit number for the treatments cultivated under screen net cover compared to the open field treatments. Between the monocropping treatments under screen net no difference in fruit number was present. Compared to the intercrop treatment under screen net they showed a significant lower fruit number.

Table 32. Total fruit number per plant.

	variety		
system	Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing	17	6	11
Intercropping + Tray Transplant	16	6	11
Intercropping + Bag Transplant	17	6	11
Intercropping + Tray Transplant + Screen net	58	26	42
Monocropping + Direct Sowing (After Shallot is harvested)	1	0	1
Monocropping + Tray Transplant	4	3	3
Monocropping + Tray Transplant+ Mulch	17	6	12
Monocropping + Tray Transplant + Screen net	45	18	31
Monocropping + Tray Transplant+ Screen net + Mulch	47	21	34
Mean	25	10	
	Variety (V)	System (S)	V * S
LSD	1.7	3.6	5.0
p =	<0.001	<0.001	<0.001

Marketable fruits per plant was with direct sowing and intercropping, 9 for Gada and 2 for Tit Segitiga (Table 33). Between open field treatments of Tit Segitiga no significant differences in marketable fruit number per plant were present. With Gada a significant lower number was present with direct sowing and transplant combined with monocropping compared to the other open field treatments. In the open field, monocropping with mulch showed a higher number than monocropping without mulch. Under screen net no difference between with and without mulch was present. Treatments under screen net cover showed a higher fruit number than treatments in the open field. This was present with both varieties. With Gada the monocropping treatments under screen net showed a lower number than the intercropping treatment. With Tit Segitiga the monocropping treatment without mulch showed a lower number compared to the intercropping treatment but was not significant different from the monocropping treatment with mulch. The monocropping treatment with mulch showed a lower number than the intercropping treatment but this difference was not significant.

Table 33. Marketable number of fruits per plant.

	variety		
system	Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing	9	2	6
Intercropping + Tray Transplant	8	3	6
Intercropping + Bag Transplant	9	3	6
Intercropping + Tray Transplant + Screen net	56	25	41
Monocropping + Direct Sowing (After Shallot is harvested)	1	0	0
Monocropping + Tray Transplant	3	2	3
Monocropping + Tray Transplant+ Mulch	9	2	6
Monocropping + Tray Transplant + Screen net	43	17	30
Monocropping + Tray Transplant+ Screen net + Mulch	46	20	33
Mean	21	8	
	Variety (V)	System (S)	V * S
LSD	1.7	3.7	5.2
p =	<0.001	<0.001	<0.001

Per square meter the number of fruits of Gada was on average 142 (Table 34). This was significant more than the number present with Tit Segitiga where 119 fruits were present. The lowest number was present with monocropping and direct sowing. Monocroppign with direct sowing and with transplants showed a lower number than the other open field treatments. Between direct sowing and transplant treatments no significant difference in

fruit number was present. Treatments under inset net covers showed a significant higher number than the open field treatments. Monocropping under screen net showed a lower number than the intercropping treatment under screen net. In the open field a higher number was present with mulch while under screen net no difference in fruit number between with or without mulch was present.

Table 34. Total fruit number per square meter.

	variety		
system	Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing	101	65	83
Intercropping + Tray Transplant	94	73	84
Intercropping + Bag Transplant	96	75	86
Intercropping + Tray Transplant + Screen net	335	307	321
Monocropping + Direct Sowing (After Shallot is harvested)	5	3	4
Monocropping + Tray Transplant	22	32	27
Monocropping + Tray Transplant+ Mulch	100	70	85
Monocropping + Tray Transplant + Screen net	262	209	235
Monocropping + Tray Transplant+ Screen net + Mulch	266	237	251
Mean	142	119	
	Variety (V)	System (S)	V * S
LSD	12.4	26.3	37.1
p =	<0.001	<0.001	0.4

Gada showed a higher number of marketable fruits per square meter than Tit Segitiga (Table 35). Treatments under screen net cover showed a significant higher number of marketable fruits than open field treatments. Intercropping showed a higher number than the number present with monocropping. Between the use of mulch no difference in fruit number was present. In the open field, intercropping treatments showed a higher fruit number than the monocroppping treatments with the exception of monocropping with mulch.

Table 35. Marketable number of fruits per square meter.

	variety		
system	Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing	55	19	37
Intercropping + Tray Transplant	48	33	41
Intercropping + Bag Transplant	51	33	42
Intercropping + Tray Transplant + Screen net	327	290	309
Monocropping + Direct Sowing (After Shallot is harvested)	4	2	3
Monocropping + Tray Transplant	18	29	24
Monocropping + Tray Transplant+ Mulch	52	25	39
Monocropping + Tray Transplant + Screen net	252	203	228
Monocropping + Tray Transplant+ Screen net + Mulch	260	231	246
Mean	119	96	
	Variety (V)	System (S)	V * S
LSD	13.1	27.8	39.3
p =	0.001	<0.001	0.5

Average fruit weight of Gada fruits was 7.6 gram, which was significant lower than the fruit weight of Tit Segitiga fruits (Table 36). Fruits of monocropping with direct sowing were significant lighter than all other treatments. Between the other treatments no difference in fruit weight was present.

Table 36. Mean fruit weight of the total production (g).

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing		7.5	8.3	7.9
Intercropping + Tray Transplant		8.0	8.6	8.3
Intercropping + Bag Transplant		7.7	8.4	8.1
Intercropping + Tray Transplant + Screen net		7.9	8.7	8.3
Monocropping + Direct Sowing (After Shallot is harvested)		7.1	7.5	7.3
Monocropping + Tray Transplant		7.3	8.6	7.9
Monocropping + Tray Transplant+ Mulch		7.7	8.3	8.0
Monocropping + Tray Transplant + Screen net		7.6	8.5	8.1
Monocropping + Tray Transplant+ Screen net + Mulch		7.7	8.3	8.0
Mean		7.6	8.4	
		Variety (V)	System (S)	V * S
	LSD	0.20	0.42	0.60
	p =	<0.001	0.002	0.6

Fruit weight of marketable fruits was on average 7.9 gram for Gada and 9.0 gram for Tit Segitiga (Table 37). Intercropping with tray transplants in the open field showed the highest fruit weight. Treatments under screen net cover showed a lower fruit weight compared to this treatment. Also monocropping with transplants and with direct sowing showed a lower fruit weigth.

Table 37. Mean fruit weight of the marketable production (g).

		variety		
system		Gada	Tit Segitiga	Mean
Intercropping + Direct Sowing		7.9	9.0	8.5
Intercropping + Tray Transplant		8.5	9.8	9.1
Intercropping + Bag Transplant		8.0	9.8	8.9
Intercropping + Tray Transplant + Screen net		7.9	8.7	8.3
Monocropping + Direct Sowing (After Shallot is harvested)		7.8	7.7	7.8
Monocropping + Tray Transplant		7.4	8.8	8.1
Monocropping + Tray Transplant+ Mulch		8.0	9.4	8.7
Monocropping + Tray Transplant + Screen net		7.6	8.6	8.1
Monocropping + Tray Transplant+ Screen net + Mulch		7.7	8.7	8.2
Mean		7.9	9.0	
		Variety (V)	System (S)	V * S
	LSD	0.35	0.74	1.04
	p =	<0.001	0.02	0.4

4 Discussion

4.1 Variety

Gada showed per plant and per square meter a higher total and marketable yield than Tit Segitiga. In previous experiments Gada already showed a higher yield per plant but did not show a higher yield per square meter. Plant population of Gada in the experiments was 50% of that of Tit Segitiga. Gada is a hybrid variety with a high potential for production due to its bacterial wilt resistance and intermediate resistance to anthracnose while Tit Segitiga does not has those resistances. In lowland the potential yield of Gada is 16 to 25 ton per hectare. In the open field only 4 ton per hectare was harvested. Under screen net cover the yield was 24 tot 25 ton. Also Tit Segitiga showed under insect net cover a yield of 25 ton per hectare. In the open field the yield of Tit Segitiga was 1 ton lower than the yield of Gada. During the experiment anthracnose and fruit fly was observed in open field treatments while anthracnose was present at a lower extend in the screen net treatments and fruits affected by fruit fly were almost absent. Since Gada has a higher level of resistance against anthracnose this might explain why in the open field Gada has a higher yield than Tit Segitiga but not with screen net covers where anthracnose was not present or only at a low level.

4.2 Raising system

Direct sowing showed a same yield as present with transplants. No difference between tray or bag transplant were present either in yield. With Gada it seemed if with direct sowing harvest started a bit sooner than at transplants. At the time of transplanting plant length and plant weight of transplants was lower than that present with direct sowing. Also in practice fields it could be noted that transplants showed smaller plants than the seedlings with direct sowing. Perhaps the cell volume of the trays and plastic bags is too small and is restricting plant growth. At the other hand yield of transplants and harvest period was not different from direct sowing and one might say that cell size is not restrictive on yield. Nevertheless with a bigger cell volume the plant might become more vegetative and less generative at the start of the cultivation leading to a higher yield with transplants compared to direct sowing.

With transplants a lower amount of seeds is needed in order to have a same plant density. With direct sowing per plant 5 seeds are required while with transplant raising per plant only 1.2 seeds are needed. In practice per plant hole farmers keep 2 plants and when excessive plants are present they are pulled out and transplanted at another plot. With this system the seed efficiency increases to 2.5 to 3 seeds required per plant. In the experiment percentage of usable plants was with direct sowing 50%, meaning per plant two seeds are needed.

4.3 Mulch

In both the open field as under screen net covers total yield increased with the application of plastic mulch. In the open field however, share of marketable production in the total production was significant lower resulting in a similar marketable yield per square meter. Under screen net cover share of marketable production was the same leading to a higher marketable yield with the use of mulch compared to the bare soil cultivation.

With mulch less water is required and weed is suppressed. Mulch can also be repellent on pests and therefore results in higher production. This was noted in the open field and under screen net covers. It is striking that the share of marketable production in the open field with mulch was quite lower than the share present at bare soil cultivation. Not observed was the reason for the high non-marketable fruits present with mulch. Possible reasons might be a higher soil temperature and soil moisture underneath the mulch leading to poor growth of the fruits. Otherwise instead of having a repellent effect, the mulch might have an attractive effect for pests causing a high percentage of fruits damaged by them.

Besides the agronomic results it will be difficult to introduce the use of mulch. In Brebes intercropping of hot pepper with shallot is commonly used and farmers are reluctant to give up this system. When hot pepper is grown together with shallot in total 360 plant holes need to be made in the mulch reducing thus the positive effect of mulch. With Gada it will be easier to introduce mulch since with this variety already half the amount of the plants, thus also half the amount of plant holes, are present compared to Tit Segitiga. With mulch soil moisture content and temperature can be higher compared to bare soil. This increases the risk of bacterial wilt. The combination of rice straw covered with black plastic mulch may be positive.

4.4 Screen net

With the use of screen net covers the yield increased from 3 – 4 t/ha to 20 – 25 t/ha. The used net was not insect proof but observed was that pest pressure inside the covers was lower than in the open field and was easier to control with insecticides. Especially less fruit fly (Dacus spp.) was observed inside the screen net covers than in the open field. Fruit fly is a rather big fly with a length of 8 mm. The hole size of the used net was 0.7 mm x 7 mm which might be small enough to inhibit in-flight from fruit flies. Also disease pressure inside the screen net covers was lower. Besides the positive effect on insects the screen net might also have enhanced climatic conditions. In the open field temperature may be higher than inside the screen net covers. In the open field it could be noted that after noon leaves from plants in the open field started to droop in order to reduce evaporation. This has also a limiting effect on photosynthesis and production. Inside the screen net covers plants still showed upright leaves and while light intensity inside the covers where lower than in the open field the level of available light combined with the duration that plants inside the covers are still productive may resulted in higher production.
Under screen net plant length was 20 cm more compared to the cultivation in the open field. Also length between internodes was longer leading to the conclusion that some etiolation occurred, but might also be related to a more vigorous growth of plants under screen net cover. Strangely enough under screen net cover a lower number of internodes was present compared to the open field. Mostly a higher number of nodes are found when crops are grown inside a greenhouse. Node formation depends probably on solar radiation, temperature and plant age. Due to a slightly lower temperature and solar radiation inside the screen net less nodes were formed. Perhaps also plant development inside the screen net covers is slower compared to the plant development in the open field.

4.5 Cropping system

With monocropping yield is mostly higher than the yield of the same crop cultivated as an intercrop with another crop. With monocropping the plant has more available space and less competition for light, nutrients and water which would lead to a higher productivity. However, in the experiment with monocropping a lower yield was observed compared to intercropping. One explanation might be the microclimate present when cultivating the hot pepper plants with shallot. In that case the shallot plants are protecting the young hot pepper seedlings against the hot weather conditions and thus enhancing the establishment of plants. With monocropping the establishment is negatively influenced resulting in a slower plant growth less vegetative growth and possible early blooming related to the plant stage. Planting date of monocropping transplants was later than the planting time of intercropping plants, but harvest period for both intercropping and monocropping was the same. This suggests that monocropping plants started to bloom sooner and produce fruits at a younger plant age than plants with intercropping.

5 Conclusions

5.1 Variety

Gada clearly showed a higher yield than Tit Segitiga. Per plant the yield was twice as much as the yield present with Tit Segitita. Per square meter results were not significant different. Both varieties showed a marketable production of 72 to 74% of the total production.

5.2 Raising system

Seed use efficiency of transplant raising is higher but yield of transplants is not different from direct sowing. With direct sowing percentage usable transplants was significant lower than with transplant raising. Seedling fresh weight was higher and also plant length was taller of directs sowing than that of transplants. Between raising in plastic bag or in tray no differences are present. Marketable yield per square meter was the same for direct sowing and transplants. With Tit Segitiga a lower share of marketable production is present with direct sowing compared to transplant use.

5.3 Mulch

Mulch was only tested in the monocropping system and showed a higher but not significant different marketable yield per square meter compared to the monocropping without mulch. Total yield per square meter was higher with mulch but share of marketable production in total production was significant lower.

5.4 Screen net

Hot pepper plants grown under screen net showed taller plants and a higher yield was present.
Total yield of plants grown under the screen net cover was 26 t/ha for intercropping with transplants. Of the total production 97% was marketable and resulted in a marketable yield of 25 t/ha.

5.5 Cropping system

With intercropping a higher yield was present compared to monocropping. Intercropping in the open field gave a total yield of 7 t/ha and marketable yield of 3.7 t/ha. With monocropping this was respectively 2.2 t/ha and 2 t/ha. Under screen net cover with monocropping total production was 18.6 t/ha and marketable yield was 18.2 t/ha. With intercropping this was 26.0 t/ha and 25.2 t/ha respectively.

6 Literature

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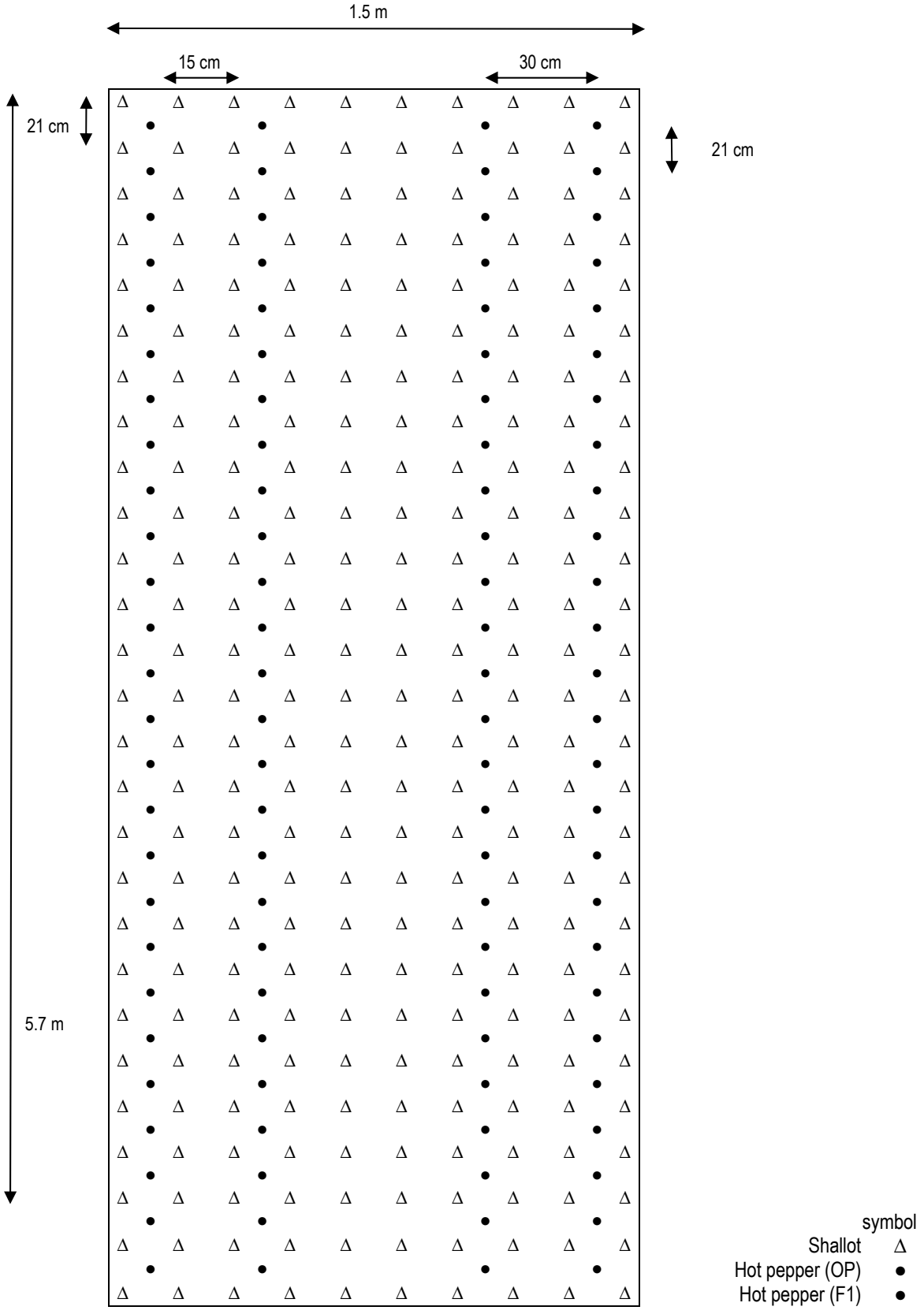
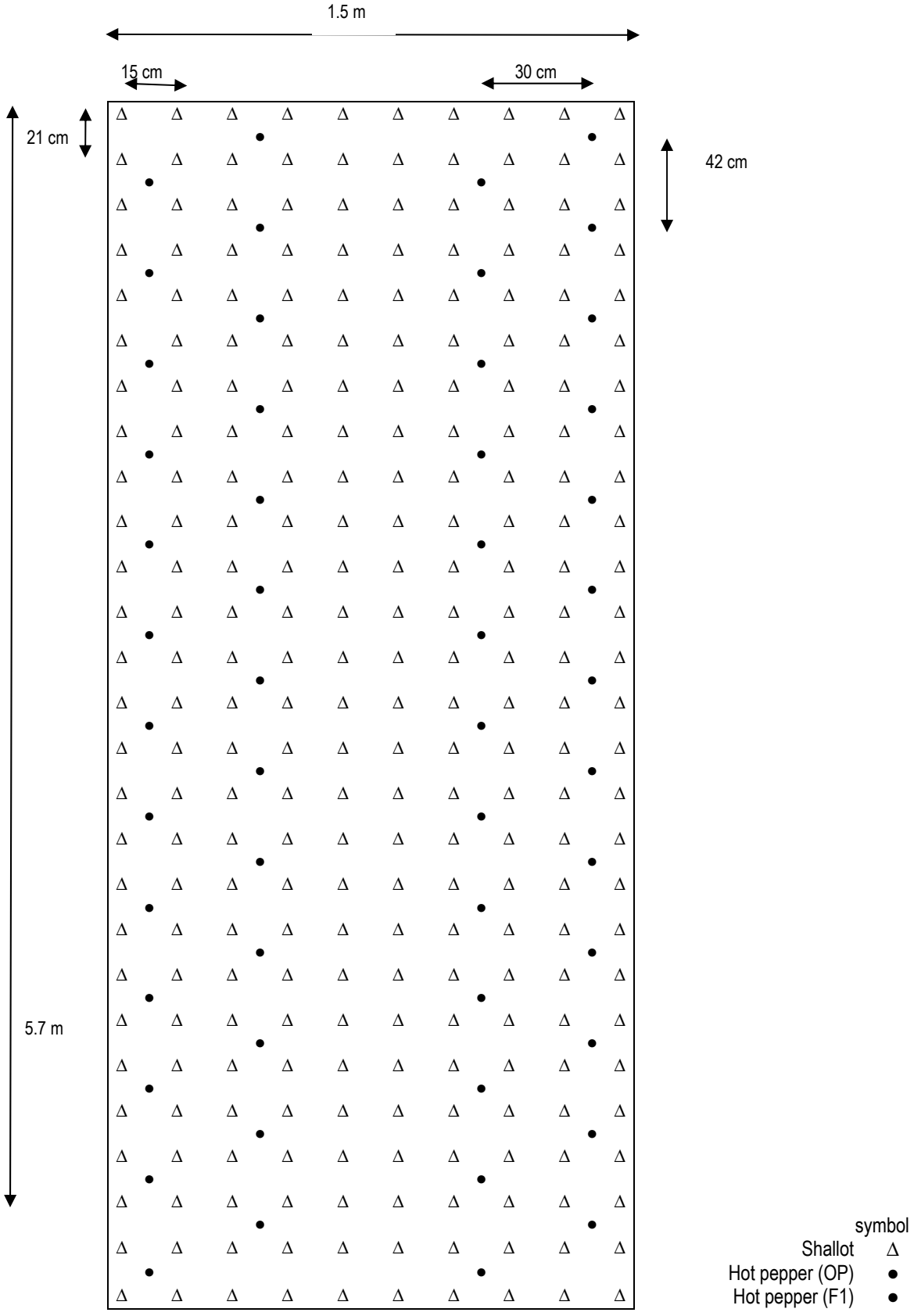
Annex I. Layout of intercropping pattern



Plant arrangement per plot for the open pollinated variety Tit Segitiga and improved open pollinated varieties Balitsa 3 and Balitsa 4 (100 plants = 11.7 pl/m2)



Plant arrangement per plot for hybrid variety Gada F1 (50 plants = 5.8 pl/m2) (recommended = 4.2)

Annex II. Layout of treatments in the nursery.

Replication 3: Nursery III ← North

36	A2B2	37	A1B6	38	A1B7	39	A1B1	40	A2B5	41	A2B1	42	A2B4
				L5						*L6*			
29	A2B3	30	A1B3	31	A2B6	32	A2B7	33	A1B5	34	A1B2	35	A1B4

III

Replication 2: Nursery II

22	A2B1	23	A2B4	24	A1B7	25	A2B3	26	A1B1	27	A2B5	28	A2B7
				L3						*L4*			
15	A1B2	16	A1B6	17	A2B2	18	A1B5	19	A1B3	20	A2B6	21	A1B4

II

Replication 1: Nursery I

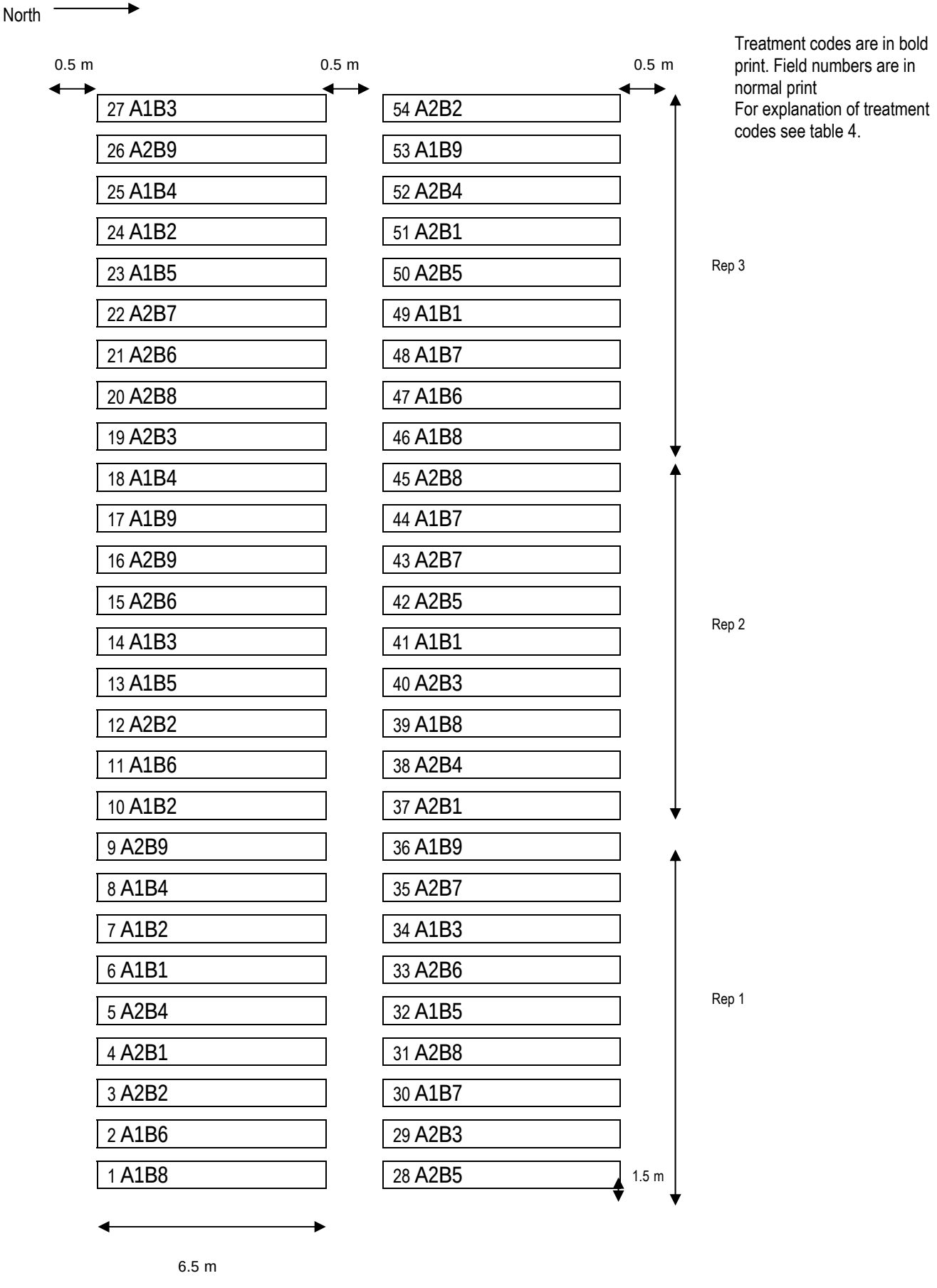
8	A2B5	9	A2B3	10	A1B7	11	A2B7	12	A1B5	13	A2B6	14	A1B3
				L1						*L2*			
1	A1B2	2	A1B6	3	A2B2	4	A2B1	5	A2B4	6	A1B1	7	A1B4

I

L1 till *L6* = light measurement position inside nursery

I, II, III = outdoor light measurement position

Annex III. Layout of treatments in the field.



Annex IV. Temperature and rainfall during the experiment.

	Rainfall	Minimum Temperature				Maximum Temperature			
date		Tegal weather station	field	nursery	screen net cover	Tegal weather station	field	nursery	screen net cover
13-3-2009	0	24.6	23	24		31.8	40	49	
14-3-2009	0	24.4	24	24		30.4	40	50	
15-3-2009	0	24.9	24	24		31.2	40	50	
16-3-2009	0	24.5	23	23		32.6	38	47	
17-3-2009	0	24.7	24	24		33.4	38	49	
18-3-2009	42	24.6	23	23		30.8	38	50	
19-3-2009	0	25.2	23	23		30.6	39	50	
20-3-2009	0	25	23	23		30.8	38	47	
21-3-2009	0	25.2	24	23		30.8	38	47	
22-3-2009	0	25	24	23		31.6	38	48	
23-3-2009	39	24.8	24	24		30.6	37	49	
24-3-2009	0	24.5	23	24		31.8	35	40	
25-3-2009	0	25.2	23	24		31.6	40	43	
26-3-2009	0	25	24	24		31.8	41	43	
27-3-2009	0	24.9	24	24		31.1	41	43	
28-3-2009	0	25.8	24	24		31	41	43	
29-3-2009	0	24	24	23		31.6	41	43	
30-3-2009	5	23.6	24	23		31.6	41	43	
31-3-2009	0	25	24	23		32	40	43	
1-4-2009	0	25	24	23		32.2	40	43	
2-4-2009	18	25.3	24	23		31	39	43	
3-4-2009	0	25.6	24	23		31.2	40	43	
4-4-2009	0	25	24	23		31.4	40	43	
5-4-2009	21	25	23	23		31.6	40	43	
6-4-2009	7	25	23	23		31	39	42	
7-4-2009	0	24.6	24	23		28.6	40	42	
8-4-2009	9	24.7	24	23		31.3	40	43	
9-4-2009	5	24.6	23	23		32	40	42	
10-4-2009	4	25.6	23	23		31.8	38	41	
11-4-2009	16	25.2	24	23		31.8	40	43	
12-4-2009	0	25.8	23	23		31.3	39	41	
13-4-2009	0	26	23	23		31.8	40	47	
14-4-2009	0	25.9	23	24		31.3	39	48	
15-4-2009	0	26.1	23	23		31.7	40	49	
16-4-2009	0	25.8	24	24		32.4	40	49	
17-4-2009	24	25.8	23	23		31.5	39	50	
18-4-2009	0	26	24	24		32.1	39	49	
19-4-2009	13	25.6	24	24		32.2	40	49	
20-4-2009	0	25	23	23		30.8	30	50	
21-4-2009	0	24.8	24	24		31.8	34	49	
22-4-2009	0	25.2	24	24		31.2	34	48	
23-4-2009	0	25.4	24	24		31.4	32	48	
24-4-2009	0	25.3	24	24		30.4	38	48	
25-4-2009	0	26.3	24	24		31.8	32	48	
26-4-2009	19	25.8	23	23		33	30	47	
27-4-2009	0	21.8	23	23		31.8	30	47	

	Rainfall	Minimum Temperature				Maximum Temperature			
date		Tegal weather station	field	nursery	screen net cover	Tegal weather station	field	nursery	screen net cover
28-4-2009	12	25.6				31.8			
29-4-2009	0	25.4	23	23		32	30	47	
30-4-2009	0	25.5	23	23		31.9	32	48	
1-5-2009	56	25.4	23	23		32.6	32	48	
2-5-2009	0	25	23	23		33	31	49	
3-5-2009	0	24.4	22	23		32.2	32	47	
4-5-2009	0	25.2	23	23		32.2	32	49	
5-5-2009	0	26.8	23	23		32	31	48	
6-5-2009	9	26.2	23	23		31.2	31	48	
7-5-2009	0	25.9	22	22		32	30	47	
8-5-2009	0	25.8	23	23		32	31	48	
9-5-2009	0	24.4	23	23		32.4	32	47	
10-5-2009	0	24.2	23	23		29.6	32	47	
11-5-2009	49	24.2	22	22		31	31	47	
12-5-2009	32	24	23	23		28.8	32	47	
13-5-2009	0	23.7	24	24		31	32	48	
14-5-2009	0	24.6	23	23		30.2	31	47	
15-5-2009	13	24.8	24	24		30.9	33	48	
16-5-2009	7	25	24	24		29.8	32	48	
17-5-2009	9	25.2	23	23		31.4	31	47	
18-5-2009	0	24	23	23		30.6	31	47	
19-5-2009	14	24	23	23		31.2	31	47	
20-5-2009	0	24.9	23	23		31.5	31	47	
21-5-2009	0		23	23			31	47	
22-5-2009	0	25.2	24	24		32	32	48	
23-5-2009	0	25.2	24	24		30.4	32	48	
24-5-2009	12	25.4	23	24		31.5	32	48	
25-5-2009	0	25.2	23	23		32	32	48	
26-5-2009	0	24.8	23	23		30	31	47	
27-5-2009	28	24.8	23	23		32.8	32	48	
28-5-2009	0	25.3	24	23		32.6	32	48	
29-5-2009	0	25.2	23	23		32.6	32	47	
30-5-2009	22	25.2	24	23		31.8	32	48	
31-5-2009	0	24.8	23	23		32.3	32	49	
1-6-2009	7	24.8	24	24		31.8	31	48	
2-6-2009	0	25	23	23		32.6	32	47	
3-6-2009	15	25	24	24		31.6	32	47	
4-6-2009	0	25	24	24		31.4	31	48	
5-6-2009	0	25	23	23		31.4	32	48	
6-6-2009	0	24.9	22	22		31.8	30	47	
7-6-2009	0	25	23	23		32	31	46	
8-6-2009	6	24.4	24	23		32	32	47	
9-6-2009	14	24.2	23	24		29	31	47	
10-6-2009	27	24.6	22	23		30.6	30	44	
11-6-2009	0	25.1	22	22		31.6	29	46	
12-6-2009	0	24.8	22	22		31.4	29	44	
13-6-2009	0	25	21	21		31.2	29	44	
14-6-2009	0	24.6	22	22		31.3	30	46	

	Rainfall	Minimum Temperature				Maximum Temperature			
date		Tegal weather station	field	nursery	screen net cover	Tegal weather station	field	nursery	screen net cover
15-6-2009	0	24.4	22	22		30.8	30	47	
16-6-2009	0	24.2	21	21		30.8	30	47	
17-6-2009	0	24.6	21	21		31.2	30	47	
18-6-2009	0	25.5	22	22		31.9	30	46	
19-6-2009	21	25.4	23	23		32.3	31	47	
20-6-2009	0	25	23	23		31.4	32	48	
21-6-2009	0	23	22	22		30.8	30	47	
22-6-2009	0	22.8	22	22		30.4	30	47	
23-6-2009	0	23.4	22	22		31.2	30	48	
24-6-2009	0	24.2	22	22		30.9	30	48	
25-6-2009	0	23.4	22	22		31	30	48	
26-6-2009	0	23.5	22	22		30.9	31	48	
27-6-2009	0	23.6	22	22		31.7	31	48	
28-6-2009	0	24	23	22		31.8	31	48	
29-6-2009	3	24.4	23	22		31.4	31	48	
30-6-2009	0	24	23	23		31	31	47	
1-7-2009	0	23.8	22	22		31	31	46	
2-7-2009	0	23.4	22	22		31.6	32	47	
3-7-2009	0	23.4	21	21		31.4	32	47	
4-7-2009	0	24.8	22	22		31.4	34	45	
5-7-2009	0	23.6	21	21		31.4	33	46	
6-7-2009	0	24.3	21	21		32.2	34	47	
7-7-2009	0	23.2	20	20		33	34	48	
8-7-2009	0	23	20	20		30.8	34	48	
9-7-2009	0	22.8	20	20		32.2	34	48	
10-7-2009	0	23.2	20	20		30.8	35	48	
11-7-2009	0	21.8	20	20		32	34	48	
12-7-2009	0	20.2	20	20		31.4	34	48	
13-7-2009	0	20.4	20	20		31	34	48	
14-7-2009	0	20.7	20	21		30.6	32	48	
15-7-2009	0	21.2	20	20		31.8	31	48	
16-7-2009	0	23	20	20		32.8	30	48	
17-7-2009	0	22.2	20	20		33.4	30	48	
18-7-2009	0	23.2	21	21	20	30.8	30	48	43.5
19-7-2009	0	23.6	20	20	20	30.7	30	48	43.5
20-7-2009	0	23.8	20	20	20	31.8	30	48	29
21-7-2009	0	23.8	20	20	20	33.8	30	47	43.5
22-7-2009	0	24.1	20	20	20	32.4	30	47	43.5
23-7-2009	0	24.4	20	20	20	32.2	29	48	43.5
24-7-2009	0	25.2	20	20	19	31.2	29	46	43
25-7-2009	23	25.4	20	20	19	31.2	30	47	43
26-7-2009	0	23.4	20	20	20	31.4	30	48	43.5
27-7-2009	0	23.6	20	20	20	31.6	30	48	43.5
28-7-2009	0	23.2	19	18	20	32.4	30	48	44
29-7-2009	0	22.8	19	19	20	33.2	30	47	42.5
30-7-2009	0	21.8	19	19	20	33.2	29	47	41.5
31-7-2009	0	22.5	19	19	20	30.8	29	47	41.5

	Rainfall	Minimum Temperature				Maximum Temperature			
date		Tegal weather station	field	nursery	screen net cover	Tegal weather station	field	nursery	screen net cover
1-8-2009	0	22.4	19	19	20	31.1	29	47	42.5
2-8-2009	0	21	19	19	20	30.4	30	48	43.5
3-8-2009	0	21	19	19	19	30.8	30	47	43
4-8-2009	0	22	20	20	20	30.7	30	48	42.5
5-8-2009	0	24	19	19	19	31	29	48	42
6-8-2009	0	23.2	19	20	20.5	33.1	29	48	42
7-8-2009	0	22.8	20	20	21	31.6	30	47	42.5
8-8-2009	0	21	20	20	21	32.1	30	47	43
9-8-2009	0	23.2	19	19	20	31.6	30	47	43
10-8-2009	0	23.2	19	19	20	31.6	30	47	43.5
11-8-2009	0	23.4	19	19	20	33.6	30	48	43.5
12-8-2009	0	24.4	20	20	20	31.4	30	48	43.5
13-8-2009	0	24.6	21	21	20.5	30.9	31	48	43
14-8-2009	0	24.6	20	21	21	33.4	31	47	42.5
15-8-2009	0	24.2	20	21	20	31.8	31	47	43
16-8-2009	0	24.2	20	21	20	31.6	30	48	43.5
17-8-2009	0	25.2	20	21	20	31.8	31	47	42.5
18-8-2009	0	24	20	21	20	31.7	31	48	43.5
19-8-2009	0	23.8	20	20	21	33.4	30	48	44.5
20-8-2009	0	23.2	20	20	20	30.7	31	47	45
21-8-2009	0	23	20	20	20	32.4	31	48	44.5
22-8-2009	0	23	21	21	20	31.6	30	47	44
23-8-2009	0	23.4	20	21	20	32.8	30	47	44
24-8-2009	0	23.5	21	21	20	31.2	31	48	43.5
25-8-2009	0	23.2	20	20	20	31.4	30	47	43.5
26-8-2009	0	22.8	20	20	20	32	30	47	43.5
27-8-2009	0	22.8	20	20	20	30.7	30	48	43.5
28-8-2009	0	23	21	21	20	31.3	31	48	43.5
29-8-2009	0	23.2	21	21	20	32.2	30	47	43.5
30-8-2009	0	23.4	22	22	20	31.2	30	47	42.5
31-8-2009	0	23.6	22	22	20	32.3	30	47	42
1-9-2009	0	24.8	22	22	20	32.6	30	38	42.5
2-9-2009	0	24	22	22	19	33.1	31	37	42.5
3-9-2009	0	23.8	21	21	19	34.4	30	37	41.5
4-9-2009	0	25.4	21	21	20	33.2	31	38	41.5
5-9-2009	0	24.2	22	22	19	33	31	37	42
6-9-2009	0	24	21	21	19.5	33	31	37	41.5
7-9-2009	0	23.8	21	21	19.5	32.4	30	38	41.5
8-9-2009	0	23.8	20	20	19	34	31	37	42
9-9-2009	0	24.2	20	20	20	33.8	30	37	41.5
10-9-2009	0	24.8	20	20	20	33	30	37	42
11-9-2009	0	25	20	20	20	32	31	36	42
12-9-2009	0	24.8	20	21	19.5	33.4	30	36	42
13-9-2009	0	24.8	20	20	19.5	33.4	30	37	42
14-9-2009	0	25	20		20	32.7	30		42.5