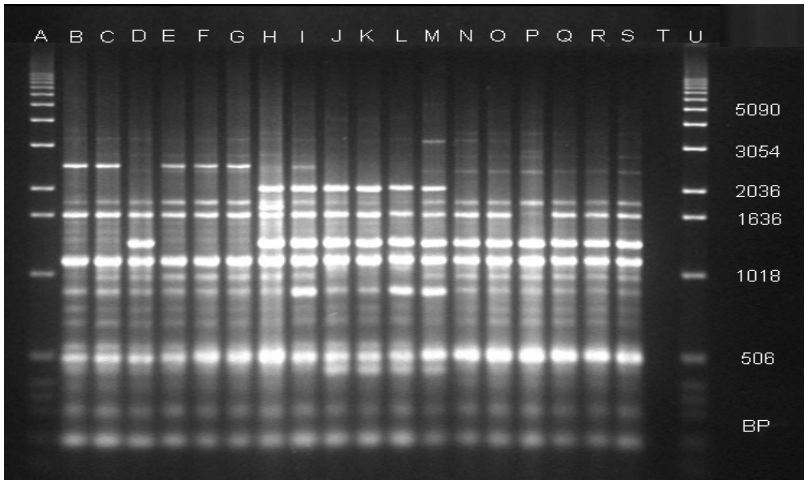

Plate 1a: Genomic diversity seen by rep-PCR with Box primer between *R. solanaceaum* biovar 2a isolates of Peru [B-G]; Colombia [H-M] and other S. American countries [N-S]

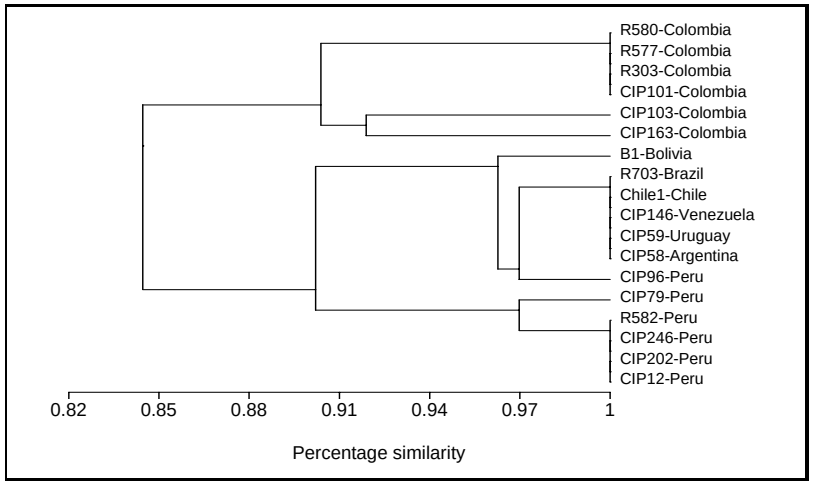

Plate 1b: Dendrogram of rep-PCR data on *R. solanacearum* biovar 2a isolates of S. America

Plate 2a: Soil microcosms for assessment of BCA survival with and without potato, and interaction with WT populations

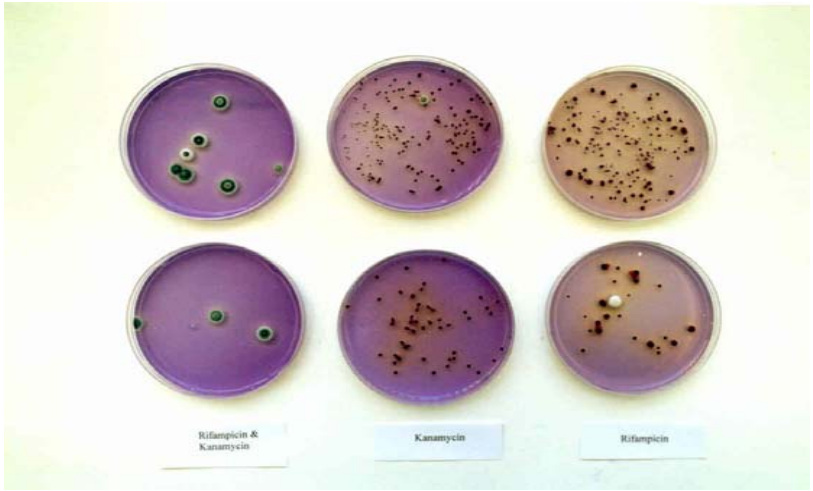

Plate 2b: Enumeration of BCA (kan), WT (rif) and recombinant (kan/rif) populations from soil on selective SMSA medium

Plate 3: SSPS seed cultivation seed spacing

Plate 4: Improvised planting aid (dibber) and seed grader

Plate 5: SSPS seed selection is targeted at medium sized tubers

Plate 6: SSPS seed cultivation planting

YEAR 2000 CALENDAR

Plate 1

Plate 2

Plate 3

Plate 4

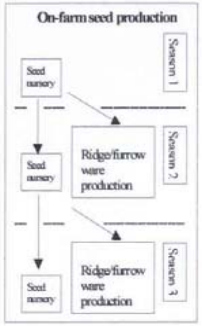

Plate 5

IMPROVING YOUR POTATO PRODUCTION:

- Talking with farmers and gaining their knowledge has helped in understanding the problems of potato production and marketing.
- The main diseases and pest problems have been identified by observing potato fields and listening to farmers.
- Potato wilt is a major disease problem leading to yield losses. No chemical will prevent this disease, only good crop management is effective.
- Potato wilt is a disease carried in the seed and the soil.
- It is very important to plant healthy seed, as this will reduce disease and increase the yield and quality of potato produced. Good quality seed is scarce and expensive, and therefore we must maximize its use. An on-farm practice that separates seed production from ware (ridge/furrow) cultivation helps in getting good quality seed.

This method:

- Maximizes land usage and empowers the farmer with producing their own good quality seed without reducing the land planted to ware production.
- Reduces the quantity of good quality seed required by an individual farmer. This makes the purchase of good quality seed affordable and increases its availability for both traditional and new varieties, such as Tigoni and Asante developed by the National Potato Research Centre.

January

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

February

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29				

March

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

[1] This publication is an output from a research project funded by the United Kingdom Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of DFID [R6629 Crop Protection Programme]. Research undertaken by Kenya Agricultural Research Institute, PO Box 147333, Nairobi; International Potato Centre, P.O Box 25171, Nairobi; and CAB International Africa Regional Centre, PO Box 633, Nairobi. Extended appreciation goes to the farmers of South Kinangop who took part in the trials for their enthusiasm, willingness to help and hospitality.

Plate 7a: Calendar January – March 2000

YEAR 2000 CALENDAR

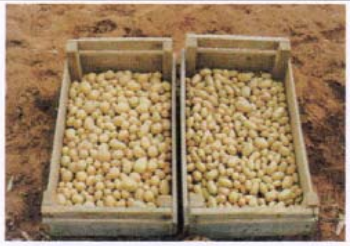

Plate 1

Plate 2

Plate 3a

Plate 3b

Plate 3c

IMPROVING YOUR POTATO PRODUCTION:

Ware production – ridge/furrow cultivation

- Seed planted must be of an ideal egg size. Planting small tubers (chats) will reduce yields. The seed should be well sprouted at planting. Chitting of tubers must be done under low light intensity, dry conditions and ideally in wooden trays such as these.
- Observe seed for disease before planting. Do not plant damaged tubers, nor tubers that have shriveled areas, appear wet or are in any way unusual. Such tubers are likely to carry disease that will spread to healthy plants and cause yield losses in the field.
- On-farm research has measured ware productivity and given a full understanding of current farmer practices.

  3a. Planting at the normal ware spacing (30cm within x 75cm between rows) maximizes yield for consumption and sale.

  3b. Earthing-up will increase yields and will also reduce the incidence of tuber moth and tuber blight.

  3c. At harvest detailed measurements on total yield and the size of the tubers produced have been taken. From these data the benefits of the research to the farmer has been measured.

April

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

May

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

June

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

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Plate 7b: Calendar April – June 2000

YEAR 2000 CALENDAR

Plate 1

Plate 2

Plate 3a

Plate 3b

Plate 4

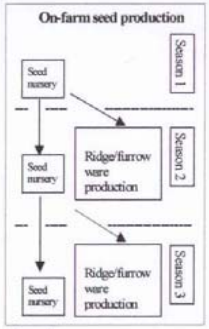

Plate 5

IMPROVING YOUR POTATO PRODUCTION:

ON-FARM PRODUCTION OF GOOD QUALITY SEED

- Extension services are available to help with this new system. Seed tubers are NOT selected from the ware crop, but produced from nursery plots. Purchase of a small quantity of good quality seed from a recognized source every 2nd or 3rd year is the only additional expense.
- Select a fertile area of land that was not under potato production last season, or ideally, several seasons before that. Also, identify an equal area of land and keep this free of potato (including volunteer potato) and other solanaceous crops. This is next season's seed nursery plot.
- Tubers are planted at 20 x 20cm on a flat bed of soil (3a). Ensure that the soil is a light tilth and create a hole about 6 – 8 inches deep and wide enough for a potato tuber. A cut-off spade handle will make an ideal hole (3b).
- Make sure that the potato is set well in the hole and then cover with soil. Look out for diseases and pests and treat immediately with chemicals or by roguing. Wilting potatoes and their neighbouring plants (even if healthy) must be rogued along with their tubers and discarded. Dehaulm early as this will reduce disease. Only select seed of an egg size. Retain enough seed to maintain the seed nursery next season, the remaining seed is for your ware production.

July

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

August

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

September

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

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Plate 7c: Calendar July – September 2000

YEAR 2000 CALENDAR

Plate 1

Plate 2

Plate 3

Plate 4

IMPROVING YOUR POTATO PRODUCTION:

THE RESEARCH BACKING-UP THE FIELD TRIALS

- At the research laboratories at KARI specific diseases are monitored. Bacterial wilt is a major concern, and the presence of this disease in seed tubers can be monitored from season-to-season using ELISA technology developed by the International Potato Centre.
- The seed nursery system has been well received by the farmers who have taken part in the field trial research in South Kinangop.
- This research is a learning experience for both farmers and researchers alike. The system is evolving through day-to-day experiences, and the opinions of the farmers continue to shape the design of the system.
- This research started with the involvement of a few farmers. Having obtained good results more farmers can be informed and involved. Farmer open days present the ideal forum to educate farmers on all aspects of seed and ware production.
- For additional information please contact the Centre Director, KARI National Potato Research Centre, Tigoni; or Centre Director, KARI National Agricultural Research Laboratories, Nairobi.

October

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

November

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

December

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

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Plate 7d: Calendar October – December 2000

[1]Advisory bulletin: March 1999

A solution to Potato Bacterial wilt and other pest problems

Multiplication of disease-free seed potato in seedplots

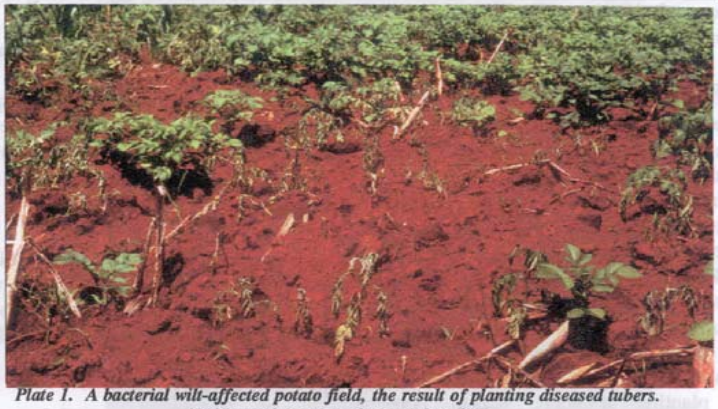


Plate 1. A bacterial wilt-affected potato field, the result of planting diseased tubers. Avoid planting tubers from such a field.

This bulletin describes the multiplication of disease-free seed potato in small plots (seedplot system). The system:

- Separates on-farm ware and seed production.
- Optimises seed-size tuber selection, promoting higher potato yields.
- Reduces on-farm land requirement for seed tuber production by 50%.
- Promotes the maintenance of seed tuber health through intensive pest and disease control.

Compiled by: Z M Kinyua (KARI) & J J Smith (CABI Bioscience - U.K). Please send your comments & feedback to: The Centre Director, National Agricultural Research Laboratories, P O Box 14733, Nairobi. Fax: (02) 443956

Background information

On-farm potato production does not achieve potential yields due to poor seed selection that is biased towards under-sized tubers from a ware cropping system. Such tubers are known to be low yielding and potentially increase tuber-borne diseases like bacterial wilt (Plate 1) and viruses. It is, therefore, necessary to optimise the use of good quality seed and maintain its health status over cropping cycles.

The seedplot system

The seedplot system separates seed production from ware production and maintains the good health status of seed tubers through intensive control of pests and diseases. The system requires 50% less land than the ware production system to meet on-farm seed tuber requirements. It is recommended that the 'freed' land be managed as next season's seed plot by leaving it fallow or planting a short season non-solanaceous crop.

Basic requirements for seedplots

1. Land. The seedplot must be established on land recognised as fertile and preferably without a history of potato production or other solanaceous crops such as capsicums, tomato and brinjals. The land should be situated where no runoff water flows into it.

2. Disease-free tubers. Obtain initial tubers from a reliable source, preferably a seed production centre or a recognised potato seed dealer. Tubers should be 2.5-5.5cm in diameter.

Land preparation and planting

Mark out beds of 2m width and a sufficient length depending on your seed needs (see Table 1). Loosen the soil sufficiently to a satisfactory depth and fine tilth.

Broadcast DAP fertiliser on the seedplot at the rate of 500g for every $9m^2$ (i.e an area of 2m width by 4.5m length) and rake it in.

Make holes at a spacing of 20cm (8 inches) by 20cm (8 inches) on the seedplot by pushing a dibber (spade handle or a similar tool) through the soil to a depth of about 15cm (6 inches) and plant a well-sprouted tuber in each hole (see Plate 2).

Weeding and hilling

Hand weeding is recommended. Ordinary hilling (earthing up) carried out in ware production fields is not necessary provided the recommended planting depth is adopted.

Disease and pest control

Seedplots need to be inspected frequently to ensure that pests (e.g aphids, potato tuber moths, e.t.c) and diseases (e.g late blight, early blight, e.t.c) are controlled promptly (see Plate 3). Fungicides (e.g. *'Ridomil'* and *'Acrobat'*) effectively control foliar fungal diseases while arthropod pests can be controlled using insecticides e.g. *'Karate'*.

Important: Removal and destruction of diseased plants, good field hygiene, crop rotation (to avoid potatoes, tomatoes, brinjals and capsicums for 3 years or more) should be practised to prevent bacterial wilt and other diseases.

Plate 8: Bacterial Wilt leaflet Page 1 & 2

Plate 2. Tubers placed in holes (8"x8" spacing) before covering with soil.

Plate 3. Inspection for pests and diseases in order to apply control measures.

Plate 4. Seed tubers of optimum size (2.5-5.5cm diameter) for good yields; avoid the use of very small tubers ('chats').

Harvesting and grading

Seedplots must be harvested about 3 weeks earlier than in a ware potato crop. Potato vines (haulms) must be removed about 2 weeks before harvesting so that tuber skin can harden.

Grading involves selecting unbruised, disease-free tubers, which are 2.5-5.5cm in diameter. Tubers outside this diameter range are unsuitable for use as seed.

Post-harvest handling

Selected tubers should be stored under conditions of diffuse light and ample aeration. A wooden crate is ideal (see Plate 4).

Usage of seedplot tubers

Tubers harvested from seedplots are divided into two lots; one lot is used in establishing a new potato seedplot as previously described and the other lot is planted in the main ware potato field at the recommended spacing of 75cm by 30cm and adopting usual management practices.

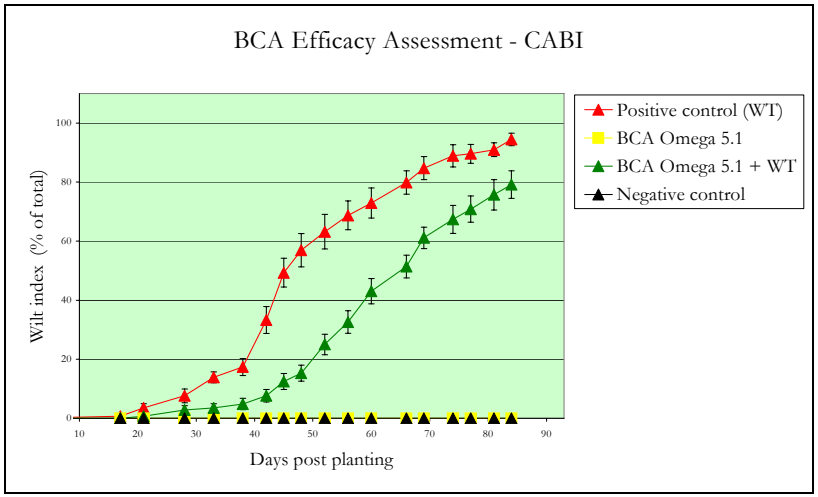
Table 1. Approximate seedplot sizes to produce adequate seed tubers for ware fields

Seed plot measurements		Ware field size (acres)
Width (m)	Length (m)	
2	4.5	0.1
2	9	0.2
2	21	0.5
2	32	0.75
2	43	1
2	64	1.5
2	86	2

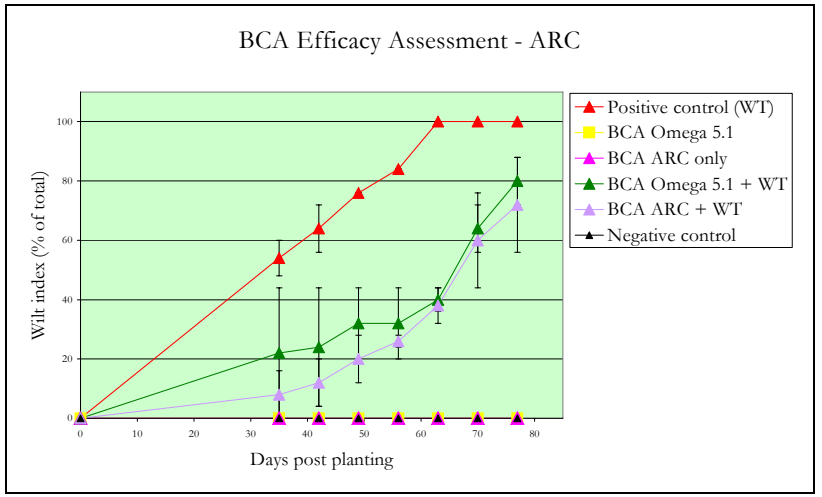
This bulletin was developed out of research activities on potato bacterial wilt in Kenya funded by the Department for International Development (DFID), U.K (Project R6629). The work was a collaborative effort between the Kenya Agricultural Research Institute (KARI) and CABI Bioscience.

Plate 8: Bacterial Wilt leaflet Page 3 & 4

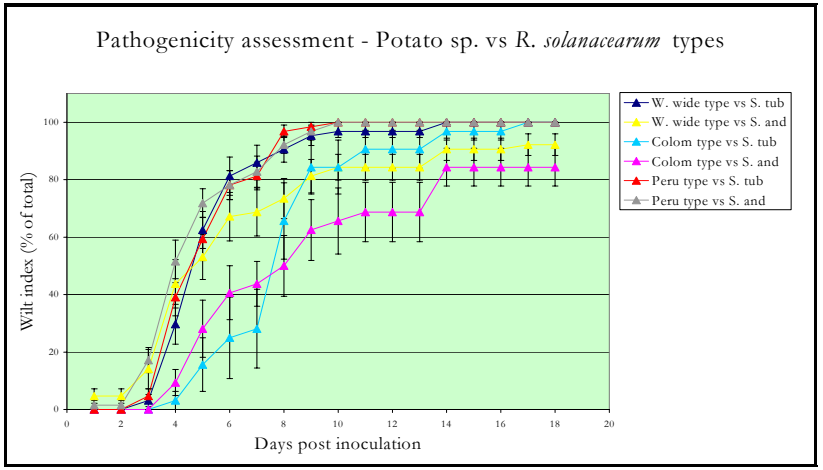
Graphs



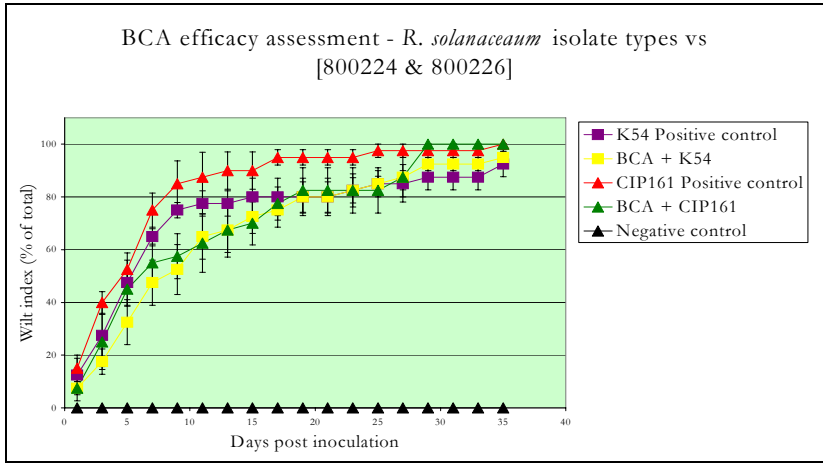
Graph 1a: Efficacy of BCA Omega 5.1 UK Centre [Egham]



Graph 1b: Efficacy of BCA Omega 5.1 and BCA ARC – ARC VOPI, Republic of South Africa

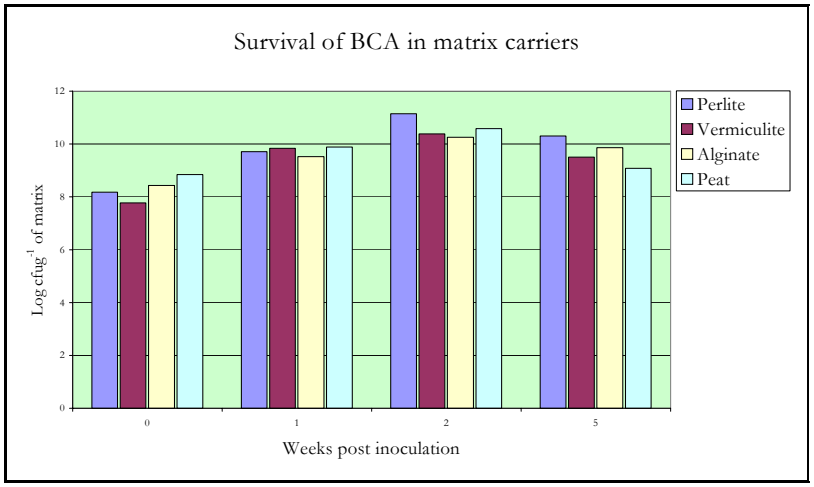


Graph 2: Interaction between solanum spp. (*S. tuberosum* and *S. andigena*) and *R. Solanacearum* isolates typical of Peru, Colombia and other world-wide countries

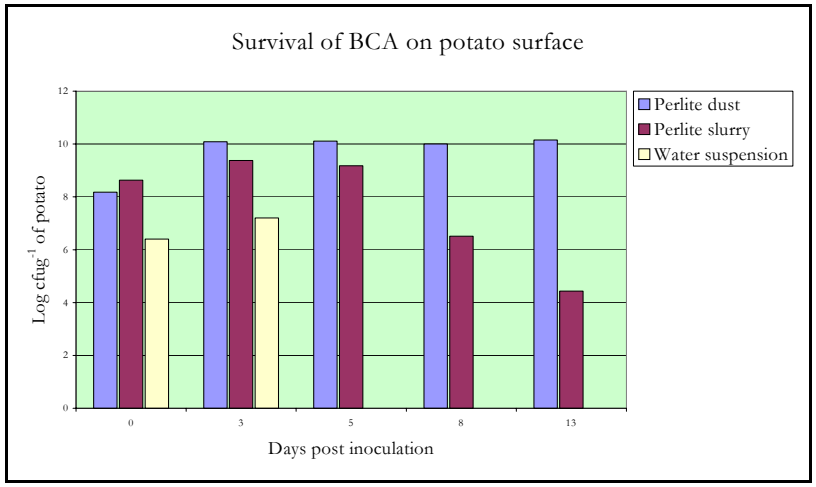


Garph 3: Efficacy of BCA against *R. Solanacearum* isolates typical of Peru and other world-wide countries (except Colombia).

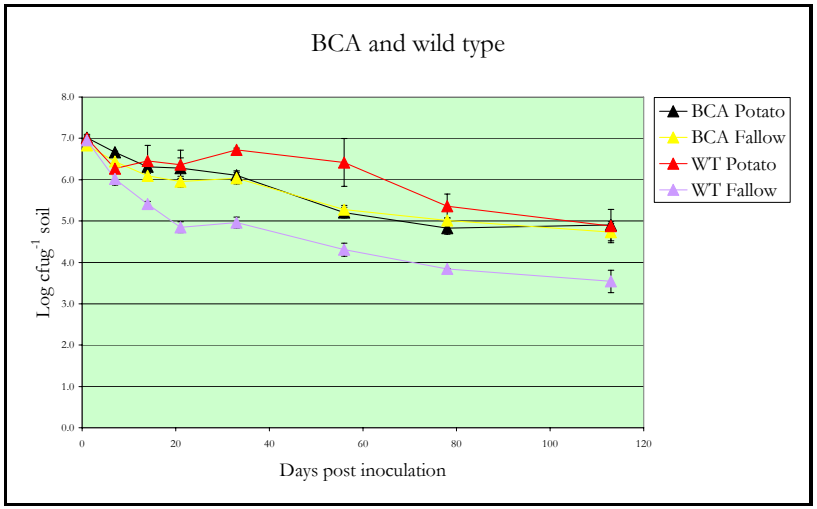
Graphs



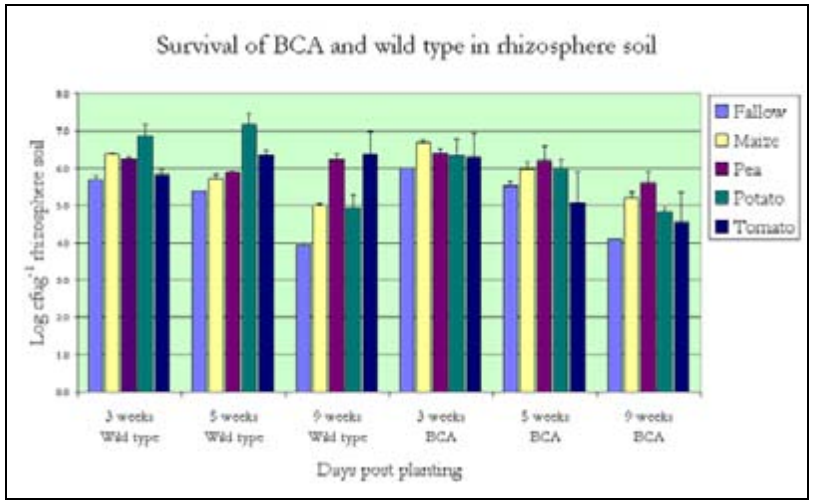
Graph 4a: Growth and survival of BCA in various matrix carriers during storage



Graph 4b: Application and survival of BCA on tuber surface during chitting

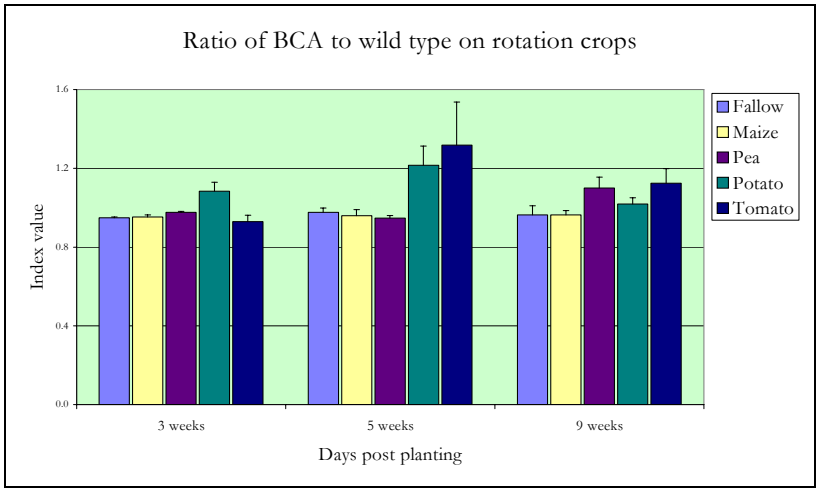


Graph 5: Survival of BCA and wild type *R. solanacearum* in soil with and without stand of potato

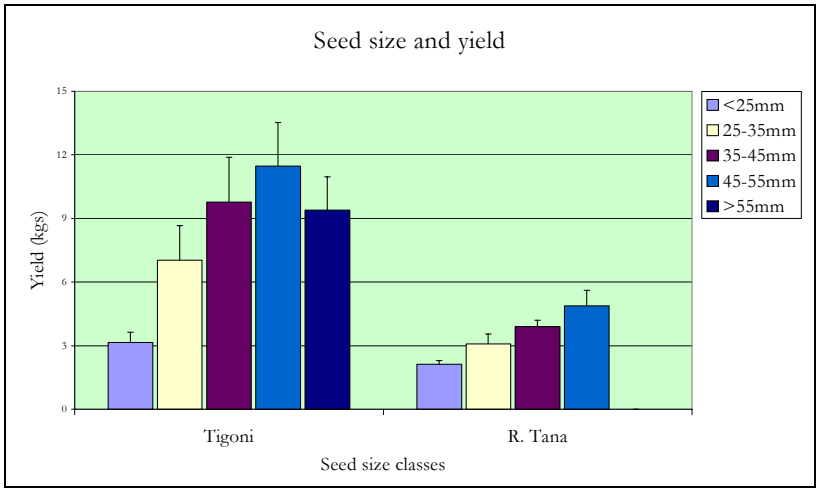


Graph 6a: Survival BCA and wild type *R. solanacearum* populations in rhizosphere soil of rotation crops

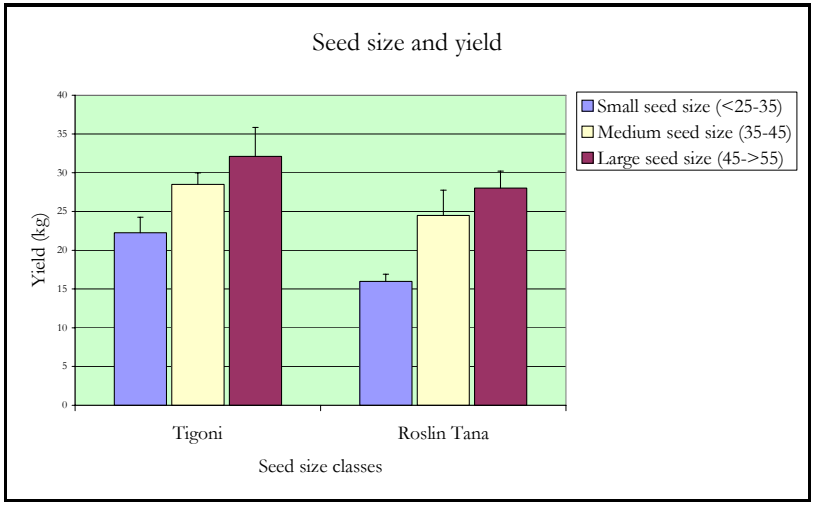
Graphs



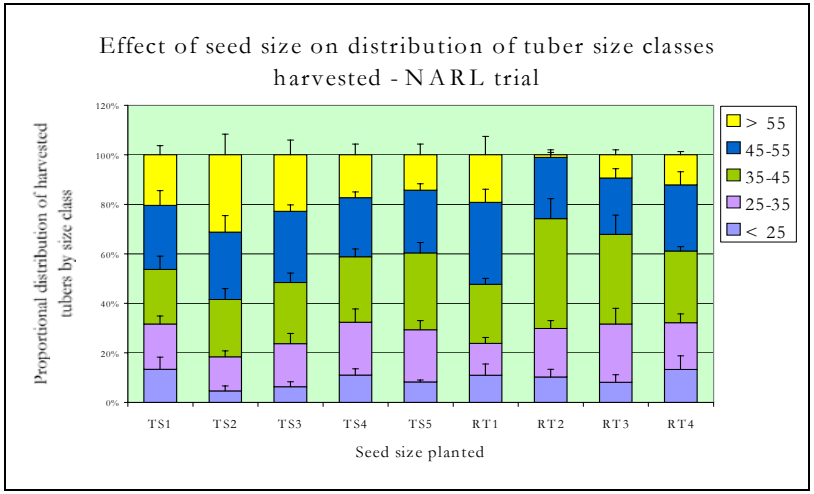
Graph 6b: Ratio of BCA to wild type *R. solanacearum* populations from rhizosphere soil of rotation crops



Graph 7a: Effect of seed size planted on yield. On-station trial undertaken at KARI NARL.

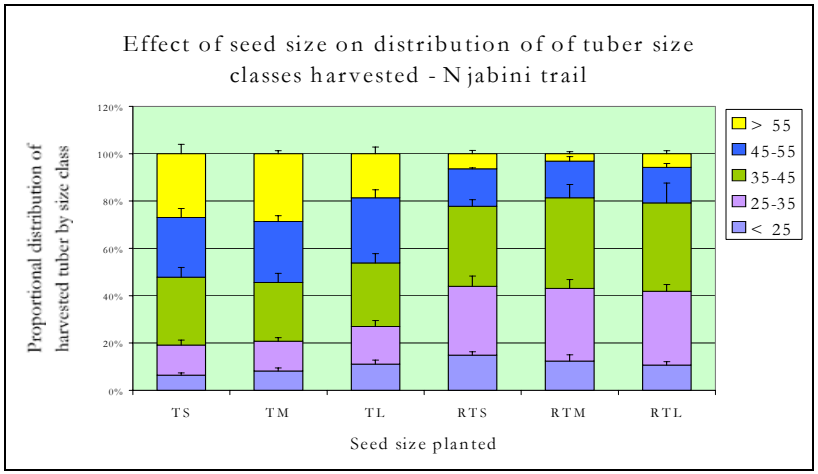


Graph 7b: Effect of seed size on yield. On-farm trial undertaken at Njabini

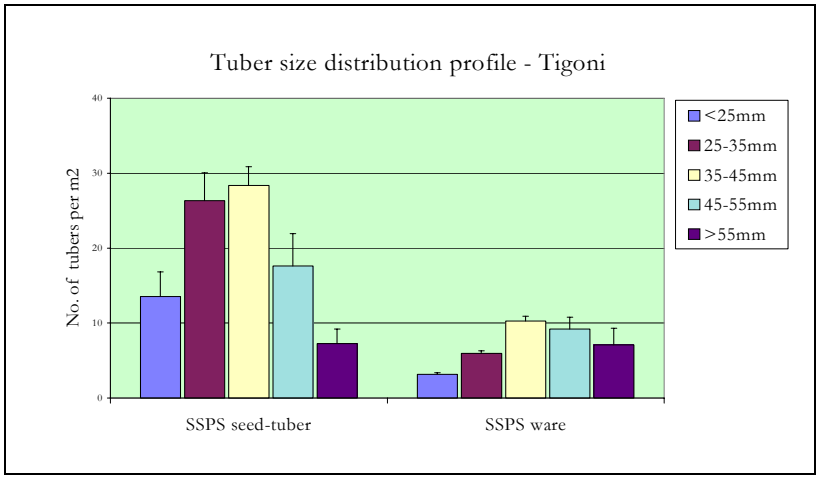


Graph 7c: Proportional distribution of harvested tubers by number per size class from seed of varying size (T1 = Tigoni <25mm, T2 = 25-35… RT1 = Roslin Tana < 25 mm, RT2 = 25-35 mm etc..

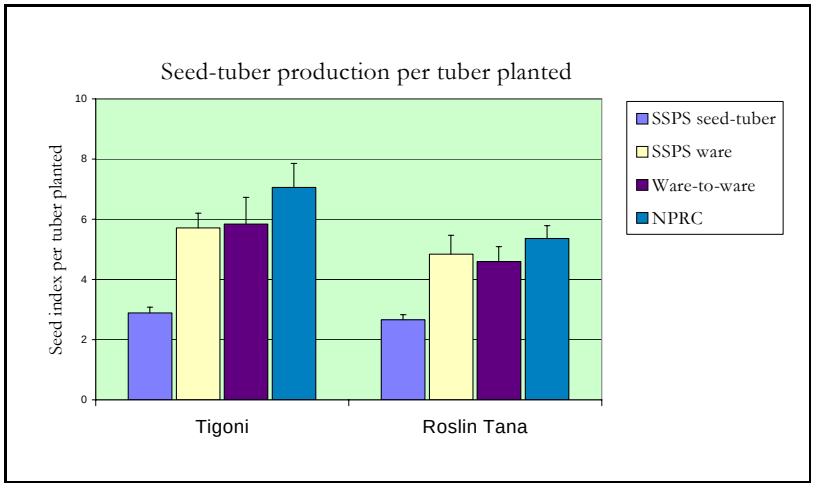
Graphs



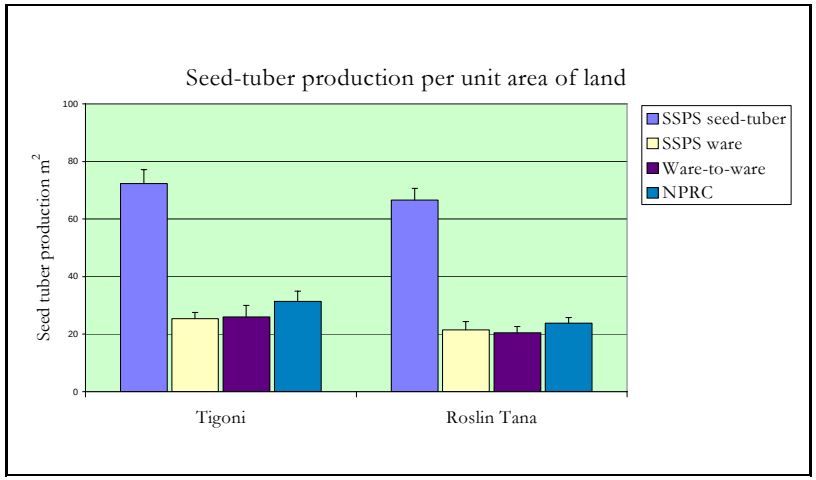
Graph 7d: Proportional distribution of harvested tubers by number per size class from seed of varying size (TS = Tigoni Samll, TM = Medium… RTS = Roslin Tana Samll, RT2 = Medium etc..



Graph 8a: Tuber size distribution profiles for Tigoni under SPSS and Ware-to-ware spacing

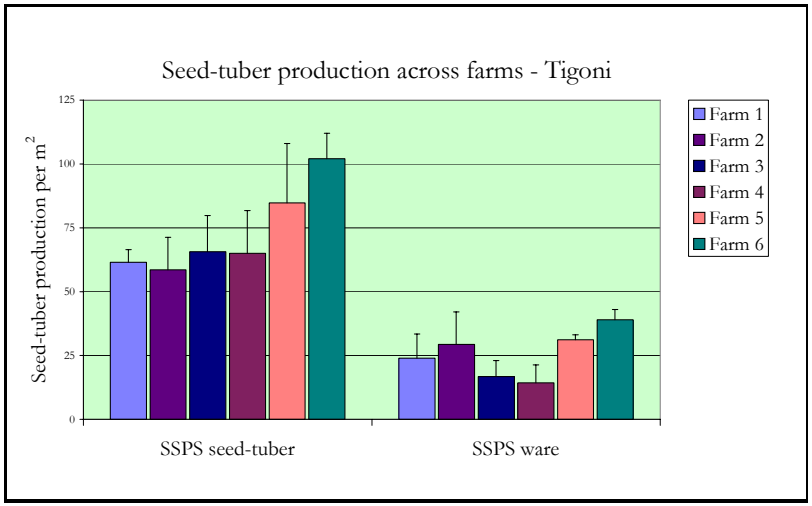


Graph 8b: Seed (25-55mm) production per tuber planted.

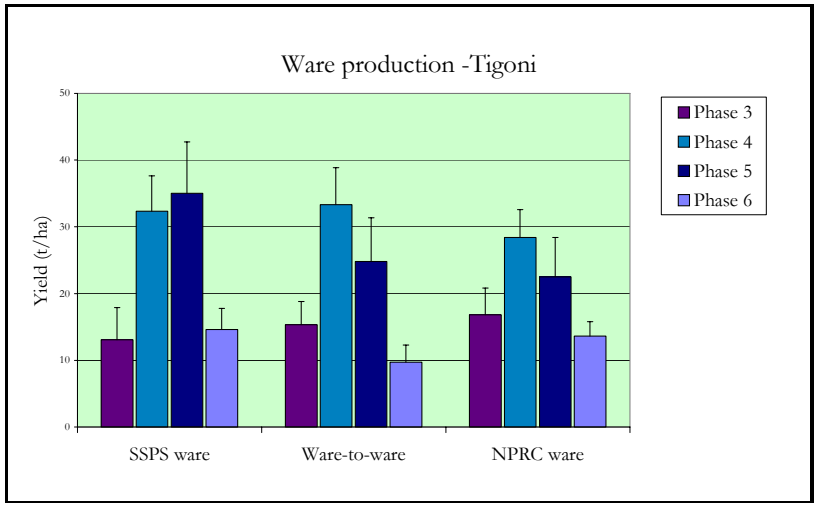


Graph 8c: Seed production per m^2 of land planted.

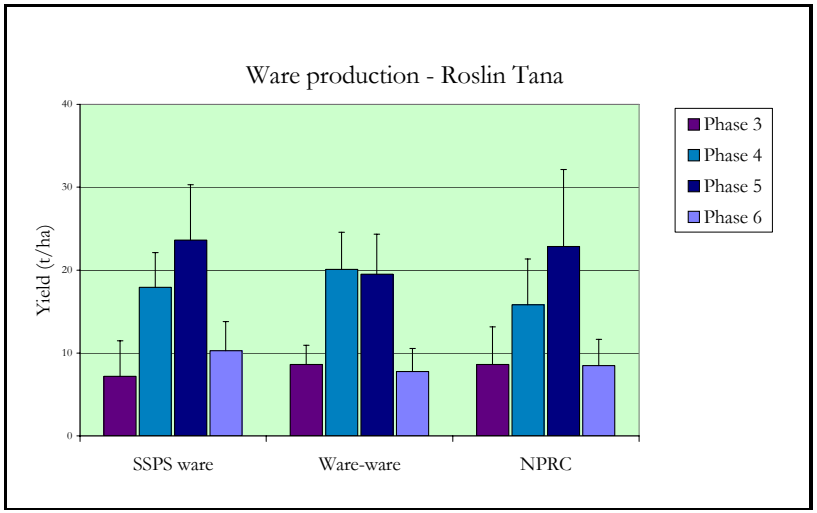
Graphs



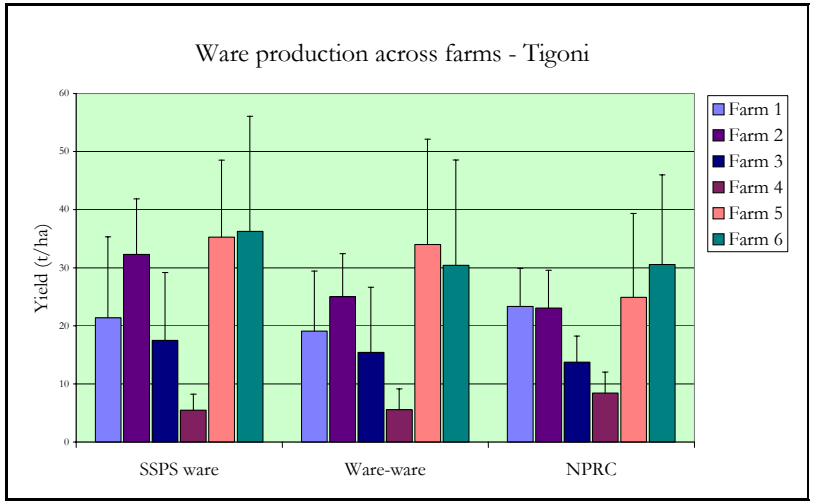
Graph 8d: Seed production across farms for Tigoni.



Graph 8e: Ware production for Tigoni

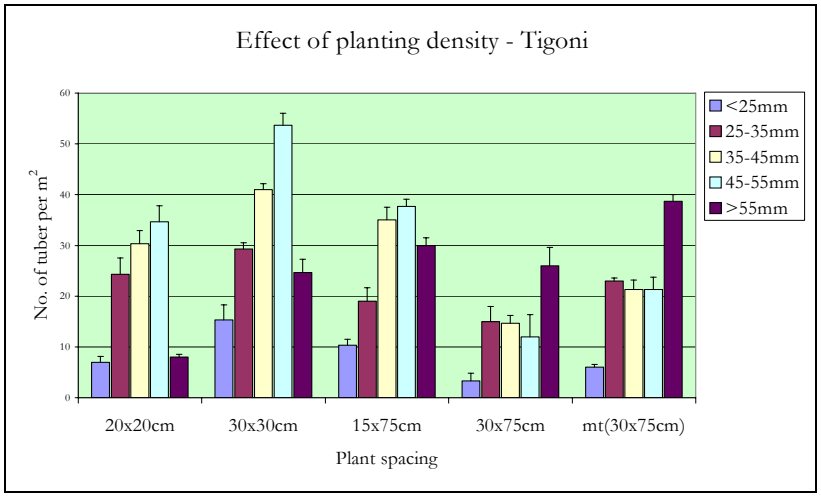


Graph 8f: Ware production for Roslin Tana

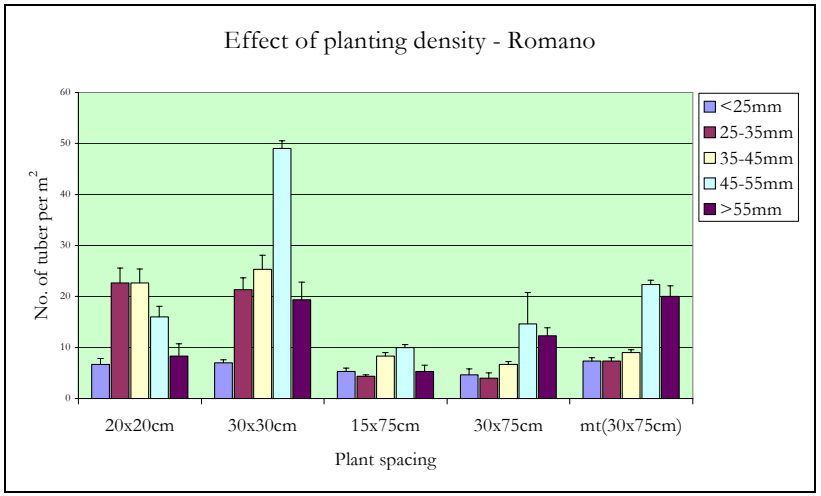


Graph 8g: Ware production across farms for Tigoni

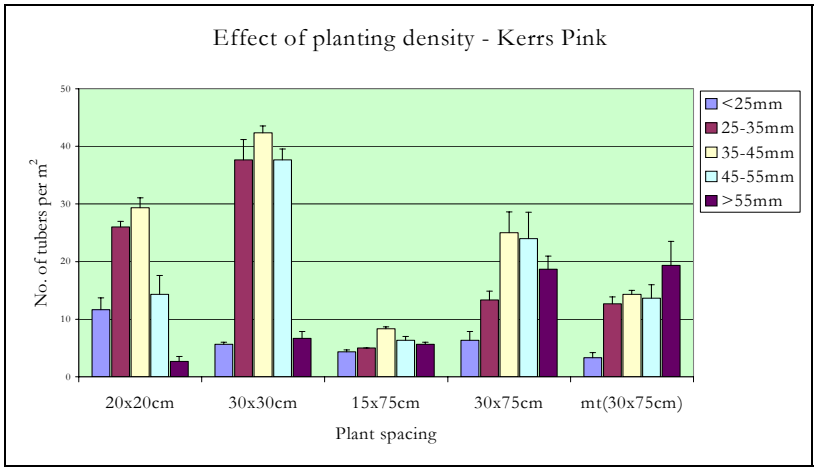
Graphs



Graph 9a: Effect of planting density and cultivation system on seed production – Tigoni



Graph 9b: Effect of planting density and cultivation system on seed production – Romano



Graph 9c: Effect of planting density and cultivation system on seed production – Kerrs Pink