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Front Line Demonstration on Multiplier Onion (*Allium cepa* L. *var aggregatum* Don) to Reduce Cost of Production.

Sharmila Bharathi C, B Mohan, R Sangeetha, G Gohila and K Paneerselvam

Krishi Vigyan Kendra
Veterinary College and Research Institute Campus,
Tamil Nadu Veterinary and Animal Sciences University, Namakkal – 637 002 (Tamil Nadu)

ABSTRACT

Front line demonstration on seed propagated Multiplier onion cultivar (cv) CO(On) 5 was carried out in Vadavathur village of Namakkal District of Tamil Nadu during Oct 2014 – March 2015 to study the cost of production of Co (On) 5. The treatments comprised of propagation of small sized onion through seed, seed treatment with bio control agents (*Trichoderma viride* and *Pseudomonas fluorescence*), nursery management for CO (On) 5, soil test based fertilizer application, foliar spray of micronutrients, and integrated pest management practices for thrips. The plant height at 45 DAP (38.5cm), number of leaf sheath per plant (23), compound bulb weight per plant (14.3-27 g) and bulb yield (20.5t/ha) were highest in CO (On) 5 compared to CO4 and Valayapatti local.

Key Words : Multiplier onion – CO (On) 5, Seed Propagation.

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops being grown all over the country. Onion is liked for its flavor and pungency, which is due to the presence of a volatile oil "Allyl prophyl disulphide"- It is dietary essential for human beings because of its nutritional and medicinal values, which commands extensive markets. Small onions are also known as shallots, multiplier or aggregatum onion is produced only in southern states of India *viz.,* Tamil Nadu, Andhra Pradesh and Karnataka and grown mainly by small and marginal farmers. As the most special and important condiment vegetable of Tamil Nadu, aggregatum onion cv.CO(On) 5 has higher market preference because of its size and appealing pink hue colour (Anbukkarasi *et al*, 2012).

The total area and productivity of small sized onion under Namakkal district was 1,997 ha and 12 t / ha, respectively in 2014. In Vadavathur village, small onion is cultivated in two main seasons *viz.,* Early *kharif* (May –August) and *Rabi* (November – December). The *kharif* crop is mainly used for seed purpose for raising next crop, whereas the rabi crop was used for vegetable purpose. CO 4 and Valayapatti local is the predominant variety cultivated at Vadavathur. The duration of CO 4 and Valayapatti local are 75 days for seed and 90 days for vegetable (Table 1). Generally small onion is propagated by means of bulbs. Totally 12.5 – 15.0q of seed bulb is required for small onion cultivation in an area of 1 hectare.

Due to high cost of seed bulbs, Krishi Vigyan Kendra, Namakkal has introduced seed propagated small onion variety Co (On) 5 through front line demonstration to reduce the seed cost. CO(On) 5679422 was developed by Tamil Nadu Agricultural University (TNAU), Coimbatore. This is a high yielding variety, with attractive pink and bold bulbs, 56146 free- flowering type with seed setting ability. It can be propagated through seed as well as bulbs. The seed rate required is 2.5 kg / ha. The objective of the study was to reduce cost of production by reducing the seed rate for small

Corresponding Author's E-mail: namakkalkvk@gmail.com, kvk-namakkal@tanuvas.org.in

Table 1. Season of Onion cultivation in Vadavathur village of Namakkal District.

Season	Month of sowing	Month of harvest	Duration (Days)	Purpose
Early Kharif (Vaikasi pattam)	May – August	July	75	Seed
Rabi(Karthigai pattam)	Nov – Dec	February	90	Vegetable (Samba)

onion cultivation as wells as to increase the net income of the farmer. The intervention consisted of six components viz., promoting small onion cultivation through supply of seed, seed treatment with bio control agents, nursery management for CO (On) 5, soil test based manuring, foliar spray of micronutrients and integrated pest management practices for thrips.

MATERIALS AND METHODS

The front line demonstrations were carried out at ten farmers' field of Vadavathur village of Namakkal District of Tamil Nadu during Rabi season 2014 - 15. In this village small onion is cultivated in an area of 425 ha. Vadavathur is situated at 11.9241^0 N latitude and 78.11917^0 E longitude and at an elevation of 531m above mean sea level. It received an average rainfall of 584 mm annually, spreading over an average of 32 days in a year. The soil type is red sandy loam with a pH of 7.9 and EC of 0.064 dSm^{-1}. Soil nutrient status of low Nitrogen (188 kg/ ha), medium Phosphorus (11 kg / ha) and high Potassium (294 kg /ha).

Nursery Management of Small Onion Cv.Co (On) 5

Raised bed nursery was prepared with a size of 70 -75 cm breadth, 15 cm height and 3 – 5 m length during second fortnight of October 2014. Total one cent area was required to raise seedling for one hectare. Well decomposed farmyard manure @ 10 kg/sq.m and 1kg neem cake was applied to the nursery bed after the removal of stones and weeds. Seeds were treated with 4 g of *Trichoderma viride* and 10 g of *Pseudomonas fluorescence* 12 hours before sowing to prevent the seed borne diseases viz., basal rot and damping off.

Treated seed were sown in line with 1 cm depth formed at 5 cm interval on the raised bed and was mulched with coconut fronds / paddy straw, which was used to maintain the temperature and moisture required for onion seed germination. Irrigation was applied through rose can after mulching and was done daily up to 40 days after sowing. The seeds germinated five days after sowing, thereafter mulch material was removed. Five days after germination, *Trichoderma viride* @ 100 gm was applied along with 25 kg of farm yard manure per nursery bed to prevent the damping of disease in seedling stage. Hand weeding was done at 10 d interval. Forty days after sowing, the seedlings were pulled out from nursery bed for transplanting.

Transplanting of Seedlings

Irrigation was applied one day prior to transplanting. Forty days old healthy seedlings (Table 2) of aggregatum onion cv. Co (On) 5 were transplanted in the flat beds at a distance of 15 x 10 cm during 1st week of December (Table 3). Fifteen days before transplanting, 100 kg of well powdered and decomposed farmyard manure enriched with one kg of *Trichoderma viride* was applied to prevent basal rot in the field. At the time of transplanting 65 kg of urea, 375 kg of super phosphate and 50 kg of potash was applied as a basal manuring per ha area. Five days after transplanting, maize as a barrier crop (NK 6240) was sown around the field and ridges at a spacing of 1 ft, to prevent the entry of thrips from the neighbouring fields. Thereafter, blue sticky traps were installed at 100 m interval with a total of 50 traps/ ha at one ft height above the onion plant to attract the thrips.

Table 2. Observation on Seedling characters of small onion var.Co(On)5

Sr.No	Observation recorded	40 days old seedling
1.	Seedling height	15.2 -18.3 cm
2.	Leaf sheath diameter	0.7-1.1
3.	Number of leaf sheath	2-3
4.	Onion bulb length in the seedling	1.0-1.3 cm
5.	Number of roots	13-21
6.	Root length	1.7-2.1 cm

Top dressing of 65 kg of urea and 50 kg of potash was done at 30 days after transplanting. Irrigation was given just after transplanting and

Table 3. Variety and Duration of Onion in Vadavathur village of Namakkal District.

Variety	Purpose	Seed rate(Kg/ha)	Month of sowing	Harvest	Duration (days)
Co4 & Valayapatti local	Seed	Seed Bulb 1,250- 1,750 kg	June	2nd week of August	75
Bulb	Vegetable		December end	March	90
CO (On) 5 Onion	Bulb	2.5kg	Nursery –October 3rd week and planting – December 1st week	March	90 days (Excluding Nursery)

later on sprinkling of water was done at seven day's interval. Foliar spray of zinc sulphate, ferrous sulphate and borax (each 3 g) was given at 30 and 45 days after transplanting. Monitoring and field visits were conducted regularly to collect feedback and provide solutions to the problems reported by the participating farmers. All the observations were recorded on randomly selected twenty five plants, except the yield (t/ha), which was computed based on the net plot yield.

Weather and Climate

During the study period (October, 2014 – March, 2015), 266 mm of rainfall was received during 19 rainy days. Maximum monthly mean temperature was 35.7°C and minimum was 23.9°C. Maximum monthly mean relative humidity was 79.7 per cent and minimum was 51.7 per cent at 07.22 and 14.22 hr, respectively (Table 4).

RESULTS AND DISCUSSION

Vegetative parameters

Among the three varieties of multiplier onion, CO (On) 5 performed well at Vadavathur village of Namakkal District (Table 5). The tallest plant height at 30 DAT (26.2cm) and 45 DAT (38.5cm) after transplanting was observed in CO (On) 5 and which was followed by CO4 (17.1 and 33.2cm) whereas the shortest plant height was recorded in Valayapatti local variety (11.5 and 22.4 cm). The highest number of leaf sheath per plant (23), diameter of leaf sheath (1.71cm), number of roots/plant (23) and root length (4.6 – 6.1cm) was observed in CO(On) 5. The reason for the better performance of these growth parameters was due to varietal character of Co(On)5 as well as optimum level nutrients added to the soil and foliar spray of micronutrients. Since nitrogen is a constituent of chlorophyll resulted in increased synthesis of photosynthates leading to better vigour. The second major nutrient phosphorus being essential constituent of cellular protein and nucleic acid might have encouraged meristematic activity of plants resulting in increased plant height and number of leaf sheath. The other major nutrient potassium is an activator of enzymes involved in protein and carbohydrates metabolism and plays an important role in the translocation of photosynthates from leaves to bulb. Similar results were reported by Bangali *et al* (2012). Onion not only needs macronutrients but also micronutrients in adequate and balanced amounts. With respect to foliar application of zinc sulphate, zinc is essential for tryptophan synthesis, which is a prerequisite for auxin formation. The favourable effect of zinc on plant growth may be due to its role in many physiological process and

Table 4: Weather parameter prevailed during the demonstration period at Vadavathur.

Month/Year	Temp (°C)		Relative humidity (%)		Wind speed	Rainfall	Rainy days
	Max	Min	Max	Min	(Km/h)	(mm)	
Oct. 2014	34.7	23.7	83.0	55.1	3.4	136	12
Nov. 2014	35.9	23.7	79.8	50.4	3.3	69	5
Dec.2014	36.3	24.0	78.5	49.5	3.1	61	2
Jan. 2015	35.5	24	78.6	52.3	3.1	-	-
Feb.2015	35.8	23.8	79	53.0	3.3	-	-
March.2015	36.1	24.2	79.8	50.4	3.0	-	-
Average	35.7	23.9	79.7	51.7	3.2	266	19

Table 5. Vegetative parameters of *Aggregatum* Onion.

Sr.No	Observation recorded	CO (On) 5	CO 4	Valayapatti local
1.	Plant height at 30 DAP (cm)	26.2	17.1	11.5
2.	Plant height at 45 DAP (cm)	38.5	33.2	22.4
3.	Diameter of leaf sheath (cm) at 45 DAP	1.71	1.02	0.87
4.	No. of leaf sheath/ Plant	23	17	13
5.	Foliage	Erect	Semi erect	Semi erect
6.	Intensity of green colour in foliage	Dark	Light	Light
7.	Number of roots/plant	23	19	17
8.	Root length (cm)	4.6 – 6.1	3.1	2.8

cellular function within plants. The same trends were also recorded by Ballabhkhasti and Rana (2012).

Yield and quality parameters

CO (On) 5 was harvested in 90 days after transplanting. The equatorial diameter of compound bulb and bulblets (4.7 and 3.6 cm), polar diameter of compound bulb and bulblets (4.47 and 4.01 cm) was found maximum in CO (On) 5 compared to CO 4 and Valayapatti local (Table 6). In case of number of bulblets per compound bulb, CO (On) 5 registered the highest (3-4) followed by CO 4. The maximum yield per plant (43 – 82 g) was recorded in the variety CO (On) 5.The variety Co (on)5 registered the highest yield (20.5t/ ha) and showed an increase of 18 % over CO4. The high yielding performance of onion variety Co(On) 5 at farmers field was also reported by Umesh Acharaya *et al* (2015). Increase in bulb yield is mainly attributed to positive association between yield and yield contributing parameters like bulb weight and size in terms of equatorial and polar diameter of the bulb and also better management of thrips in the onion field through barrier crops and blue sticky traps. Thrips are weak fliers and can be carried by wind. Therefore, planting live- barriers like maize could effectively block adult thrips from reaching onion plants.Two rows of maize surrounding onion field blocks adult thrips up to 80 per cent and blue sticky traps attracted the thrips in the inside field up to 90 per cent (Srinivas and Lawande, 2006). This practice brings down insecticide application.

Thickness of neck is one of the important character which indicates vigour of the plant (Manna, 2013). Small onion cv.Co(On) 5 registered maximum neck thickness and also possessed good dry skin colour and fleshy scale colour compared to other varieties (Table 7). The storage period of Co(On) 5 under low cost bottom ventilated storage structure was one month only with sustained quality parameters because it contains high moisture in the bulb. Hence it was recommended for immediate sale at one month after harvesting.

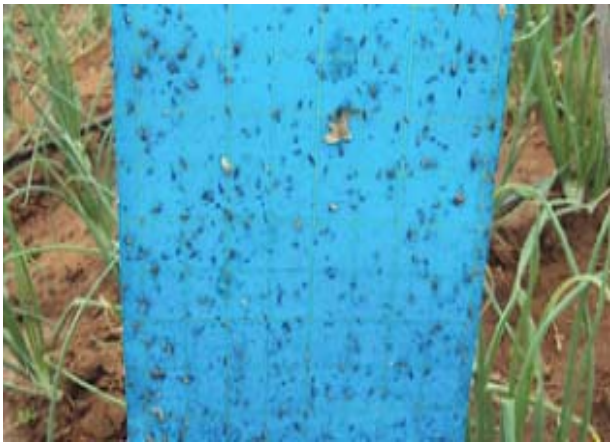
The economic analysis (Table 8) revealed that the highest expenditure (Rs.1,07,976 /- ha) was incurred in cultivating onion var.CO4 as compared to Co (On) 5 (Rs.87,306 /- ha) and the maximum net return (Rs.3,17,694/- ha) was obtained from the variety Co (On) 5. The highest cost of

Table 6. Yield parameters of Aggregatum Onion

Sr.No	Observation recorded	CO (On) 5	CO 4	Valayapatti local
1.	Equatorial diameter of compound bulb (cm)	4.7	4.5	3.9
2.	Polar diameter of compound bulb (cm)	4.47	4.02	4.00
3.	Equatorial diameter of bulblet (cm)	3.6	3.4	2.7
4.	Polar diameter of bulblet (cm)	4.01	3.23	3.18
5.	Number of bulblets per compound bulb	3- 4	2 -3	2-3
6.	Weight of the compound bulb (g)	14.3 - 27	6 - 8.02	5.8
7.	No.of compound bulbs/Kg	23 -25	40-46	69 -71
8.	No.of bulblets/kg	82	89-96	152
9.	Yield/ plant (g)	43 - 82	19-24	16 - 19
10.	Yield/ ha (t)	20.5	16.8	12.0

Co(On) 5 Nursery

40 days old Co(On) 5 seedling



Blue sticky trap installed onion field

Maize as a barrier in onion field

Harvested Co(On) 5 onion

cultivation was due to highest seed rate and high price of seed bulb. Therefore, farmers can save an amount of Rs.31,250/- besides getting additional profit of Rs.2,86,444/- while growing CO(On) 5 with low seed rate. The Cost: Benefit ratio also highest (1:4.6) in case of CO(On)5.

CONCLUSION

The *Aggregatum* onion cultivation with low seed rate (2.5kg/ha) variety Co(On) 5 proved economically viable intervention for the farmers. Any seed - setting onion variety, is preferred by the farmers over the bulb-propagated ones, as it

Table 7. Quality parameters of *Aggregatum* onion.

Sr. No.	Parameter	Characteristic		
1.	Thickness of neck (cm)	1.2 -1.5	0.9- 1	0.8-1.0
2.	Basic colour of dry skin	Dark red	Pink	Dark pink
3.	Adherence of skin after harvest	Medium	Medium	Strong
4.	Colour of epidermis of fleshy scale	Whitish pink	Whitish pink	Whitish pink
5.	Position of root disc	Exerted	Inserted	Exerted

Table 8 .Cost Economics of *Aggregatum* Onion / ha

S.No	Cultural operations	Particulars	Total amount (Rs.)	
			Farmer practice CO 4	CO (ON) 5
1.	Ploughing	Tractor ploughing -2 times @ Rs. 1500 / ha + One rotavator ploughing @Rs.2500/ ha /3 hr	3000.00 2500.00	3000.00 2500.00
2.	Land preparation , Bed and Channel formation	On contract basis @Rs.6000/day/ ha	6000.00	6000.00
3.	Seed rate / 0.4 ha (Depending upon the bulb size)	1250 -1500 @ 81kg/Bag : Rs.2000 - 2500/bag 1kg/0.4 ha	37500.00	6250.00
4.	Seed treatment	SAAF (Carbendazim 12% + Mancozeb 63% WP) @ 2g/Kg 3.75 Kg/ha @Rs.650/Kg *Trichoderma viride* @ 4 g/ Kg + *Pseudomonas fluorescence* @ 4g/Kg	2438.00 - 	- 110.00 110.00
5.	Nursery raising	Raised bed formation & seed sowing @ Rs.500/day	- -	500.00
6.	Planting of seed bulbs	On contract basis – 60 ‘B’ type labours @ Rs.150/ day (8 am – 4pm) Applied *Trichoderma viride* 1 Kg + *Pseudomonas fluorescence* 1 Kg + 100 kg FYM just before planting.	9000.00 -	9000.00 425.00
7.	Weedicide (3- 5 days after planting)	Goal (Oxyfluorfen) @ 30 ml tank : 30 tanks/ ha @ Rs.1810 /litre + Spray charge Rs.30/tank) Hand weeding 2 times12 ‘B’ type labours @ Rs.150/ day x for 2 times	2525.00 -	- 9000.00
7.	Manuring	Factomphos – 5 bags / ha (applied 22 days after planting) @ Rs.950/bag Potash @2.5 bag/ ha (40 DAP) Labour charges for manuring Urea – 130 kg @ Rs.320/bag Super phosphate – 375 kg @ Rs.372/bag Potash – 100 kg @ Rs.800/bag and labour charge for manuring Foliar spray of vegetable micronutrient formulation @ 2 gm/litre at 30& 45 DAP (25 tank (12 litre/tank) /ha Rs.115/500g. Labour charge for 2 sprays @ Rs.30 /tank, for 50 tanks	4750.00 2000.00 750.00 - 	- 1600.00 2790.00 2000.00 750.00 288.00 1500.00
8.	Irrigation	One irrigation at the time of planting 3 DAP – life irrigation After 22 DAP- One week interval: 8 irrigation	5000.00	5300.00

S.No	Cultural operations	Particulars	Total amount (Rs.)	
			Farmer practice CO 4	CO (ON) 5
		Labour charges for 10 irrigation @ Rs.500 / day (7 am- 2 pm)		
9.	Plant protection (6 chemical sprays) For Thrips (*Thrips tabaci*) management – 40 DAP at 8 days intervals.	1. Profex super 40 EC (Profenofos + Cypermethrin) @ 2ml/litre-25 tank/ ha, for 2 times Cost :Rs.200/250 ml	1000.00	-
		2. Nayak (Alpha methylin) @ 2ml/litre-25 tank/ ha, for 2 times, Cost :Rs.200/250 ml	1000.00	
		3.Curacron (Profenofos) @ 2ml/litre-25 tank/ ha, for 2 times, Cost :Rs.240/250 ml	1200.00	
		Border crop (1 feet interval) of Hybrid maize NK 6240 @ Rs.230/Kg 250 g/ha	-	58.00
		Blue sticky traps @ 50 trap /ha @ 40/Trap		2000.00
10.	Harvest	30 'B' type labours @ 150 / labour	4500.00	4500.00
	Separation of onion bulbs from onion (Curing) plant.	1'B' type labour – 2 bags (81 kg)/ day @ Rs.120 /bag For 16,750 kgs For 20,000 kgs	24,813.00	29625.00
		Total Expenditure / ha	107976.00	87,306.00
11.	Yield	207 bags / ha @ 81 Kg/Bag @Rs.15 / Kg	2,51,505.00	-
		250 -275 bag /ha @Rs.20/Kg	-	4,05,000.00
	Net profit		1,43,529.00	3,17,694.00

would ensure a saving of up to Rs 31,250 – 37,500 per hectare in the cost of seed bulb alone. Besides, raising the income level the intervention provides livelihood security to onion growers of the area. Considering the productivity and profitability the farmers expressed satisfaction with the performance of onion var.CO (On)5 because it got better market preference due to its size and appealing attractive dark pink colour. The farmers of adjoining areas are also convinced and interested to adopt onion cultivation with CO (On) 5 variety.Therefor variety CO (on) 5 can be reco fal cultivation in Nammakal District.

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