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Yield and profit enhancement in small onion through demonstration

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Abstract
Small Onion (*Allium cepa* L. var. *aggregatum* Don.) is one of the important commercial vegetable crops cultivated in Dharmapuri district, Tamil Nadu. The yield of onion is affected by the incidence of various pests and diseases. Thrips, basal rot and purple blotch disease incidence are considered as the important factor in influencing the bulb yield of onion. Adoption of integrated approach will be the most economical and sustainable one for managing the above said problems in onion. Hence, frontline demonstration on integrated management practices in small onion was conducted in farmers' holdings. The results revealed that adoption of integrated management practices including seed bulb treatment and soil application of *Trichoderma viride*, soil application of biofertilizers, neem cake, placing of yellow sticky traps, spraying *of Beauveria bassiana* and need based spraying of chemical pesticides recorded higher bulb yield (13.8 t/ha) and net return (Rs. 201100/ha) besides reduction in incidence of pests and diseases in onion. As a result, the demonstrated technological interventions were adopted in large scale by the onion growers of Dharmapuri district.

Keywords: Small onion, demonstration, thrips, basal rot, purple blotch, bulb yield

Introduction
Small Onion also known as aggregatum onion (*Allium cepa* L. var. *aggregatum* Don.) is one of the important commercial vegetable crops grown in Dharmapuri district, Tamil Nadu. It is cultivated in an area of 700 ha. It is productivity is low due to the occurrence of biotic and abiotic stress. Among the biotic stress, incidence of pest and diseases especially thrips, basal rot and purple blotch disease causes major damage and leads to 20-30 per cent yield loss. Thrips (*Thrips tabaci* L.), is considered as a key pest of onion and it causes 46-87 per cent yield loss (Srinivas and Lawande, 2004) [4]. The nymphs and adults feed on green leaf tissue, suck the sap, causing direct damage by destroying epidermal cells. They feed by piercing the surface tissue and imbibing exuded cellular contents. The empty cells on attacked plants create silvery white spots and thereby make the plants less marketable (Koschier *et al*., 2002) [5]. Thrips infestation also aggravates purple blotch, stem phyllum blight and Iris eye spot virus diseases in onion (Hoepting *et al*., 2007; Zen *et al*., 2008, Lawande *et al*., 2010) [2, 1]. Basal rot is the most destructive disease of onion and it is caused by *Fusarium oxysporum* f.sp. *cepae*. During initial stage, affected plant shows yellowing of leaves and stunted growth. In advanced stage, bulb starts decaying from lower end and ultimately whole plant die. It causes up to 50 per cent yield loss in onion (Everts *et al*., 1985) [7]. Purple blotch disease is caused by *Alternaria porri* and it generally occurs when the temperature is 18 to 30°C and relative humidity is 80-90 per cent. It causes small brown spots with purplish centre in the older leaves of plant and subsequently it form into lesions and drying of leaves. Purple blotch disease causes 20-25 per cent yield loss and the severity of the disease is higher in the thrips affected fields (Yasodha and Natarajan, 2008) [6].

Farmers rely on chemical pesticides for managing these pests and diseases and achieving high yield in onion. Itcauses increase in the production cost and thereby lowers the income.Besides, continuous use of chemical pesticides for managing pests and diseases causes environmental hazard and build-up of resistance in the pests and pathogens.It ultimately affects the human health and microbial diversity. To overcome the problems, integrated use of cultural, chemical and biological methods for managing pest and diseases is recommended for achieving effective plant protection without reduction in crop yield. Knowledge on the use of integrated approach among the onion growers is meagre. Hence, a frontline demonstration on the recommended integrated management practices in small onionwas conducted in the farmers' holdings of Dharmapuri district.

Materials and Methods

Frontline demonstration was conducted to demonstrate the effectiveness of the integrated crop management practices in comparison with the existing farmers practice in the farmers' holdings of Dharmapuri district during 2020-21. Demonstration was conducted in 10 locations spread over in Palacode, Pennagaram, Karimangalam and Nallampalli, blocks of Dharmapuri District. The soils of the demonstration fields were neutral in soil reaction, non-saline and low to medium in fertility status. Each demonstration was conducted in an area of 0.4 ha and with an adjacent area of 0.4 ha selected for farmers practice.

In the demonstration plot, seed bulb treatment with *Trichoderma viride* @ 5 g/kg, soil application of *Trichoderma viride* @ 1.25 kg/ha, VAM fungi @12.5 kg/ha, Azophos @ 4 kg/ha, neem cake @ 250 kg/ha before planting, placing of yellow sticky traps @ 12 numbers/ha, spraying of *Beuveria bassiana* @ 10 g/lit on 30 days after planting and need based spraying of chemical pesticides such as profenophos @ 2 ml/lit, mancozeb @ 2 g/lit for managing thrips and purple blotch disease were followed. In the farmers practice, onion bulbs were sown without treating with bio inoculants. The chemical pesticides such as profenophos, carbendazim were sprayed thrice in combination for controlling the thrips and rot problem. The recommended crop management practices *viz*., optimum seed rate, spacing, integrated nutrient management were uniformly followed. The details on the technological interventions followed in the demonstration and farmers practice are given in Table 1.

Table 1: Technological interventions followed in small onion under demonstration and farmers practice

S. No.	Technological interventions	Demonstration	Farmers practice	Gap
1	Farming situation	Irrigated	Irrigated	-
2	Variety	CO 4	Local	Full gap
3	Seed treatment practice	Seed bulb treatment with *Trichoderma viride* @ 5 g/kg	Not followed	Full gap
4	Use of soil amendments and bio fertilizers	Soil application of *Trichoderma viride* @ 1.25 kg/ha, VAM fungi @12.5 kg/ha, Azophos @ 4 kg/ha, neem cake @ 250 kg/ha before planting	Not followed	Full gap
5	Nutrient management	Basal application of FYM @ 25 t/ha; Recommended dose of NPK @ 60:60:30 kg/ha	Basal application of 20:20:20 complex fertilizer @ 125 kg/ha	Partial gap
6	IPDM practices	IPDM practices were followed. • Placing of yellow sticky traps @ 12 numbers/ha • Spraying of *Beauveria bassiana* @ 10 g/lit on 30 days after planting • Need based spraying of chemical pesticides such as profenophos @ 2 ml/lit, mancozeb @ 2 g/lit for managing thrips and purple blotch disease	IPDM practices were not followed. • Spraying of profenophos @ 1 ml/lit and carbendazim @ 2 g/lit thrice in combination for controlling the thrips and rot disease	Full gap

Before initiating the demonstration, the beneficiary farmers were trained in all the technological interventions to be followed in the demonstrations. Demonstration field were periodically observed by the scientists of Krishi Vigyan Kendra and advisory recommendations were followed. At the time of harvest, the data on pest and disease incidence and bulb yield were recorded from both the demonstration and farmers practice. Based on the cost of inputs and market price of the produce, economic parameters such as net return and benefit cost ratio were worked out.

Results and Discussion

Results on the demonstration indicated that the per cent incidence of thrips, basal rot and purple blotch were 5.33, 6.0, 4.0 respectively under demonstration and 25.3, 17.0, 19.0 respectively under farmers practice (Table 2). It indicated that adoption of integrated management practices including seed bulb treatment and soil application of bio inoculants effectively reduced the basal rot disease. Ilhe *et al*. (2013) [10] reported the similar findings of application of *Trichoderma viride* inhibited the growth of onion basal rot disease causing fungi *Fusarium oxysporum* f.sp. *cepae* by 85 per cent. Malathi (2015) [9] also reported that use of biocontrol agents *Trichoderma* sp., *Trichoderma harzianum* reduced the basal rot incidence by 83 per cent and enhanced the growth and yield of onion. Muthuraman and Sekar (1998) [11] and Sudhasha *et al*. (2009) [12] also reported similar findings in onion. Placing of yellow sticky traps and spraying of *Beauveria bassiana* reduced the thrips and purple blotch disease incidence. Gothandapani *et al*. (2015) [13] and Almazraawi *et al*. (2009) [14] also reported the effectiveness of *Beauveria bassiana* alone and in combination with bio pesticides for management of onion thrips.

Table 2: Pests and disease incidence in small onion as influenced by farming practices

Treatments	Thrips incidence (%)	Basal rot incidence (%)	Purple blotch incidence (%)
Farmers practice	25.3	17.0	19.0
Demonstration	5.33	6.0	4.0

Demonstration of recommended integrated practices recorded higher bulb yield of 13.8 t/ha and it was 14.0 per cent increase over farmers practice. It is mainly due to the adoption of integrated crop management practices and effective management of pests and diseases through integrated approach.

The extension gap indicated the difference in yield between the demonstration and farmers practice and it was 1.7 t/ha. This might be due to lack in adoption of integrated crop management practices. It indicates that there is a need to encourage and motivate the farmers for adoption of integrated crop management practices over the existing farmers practice.

With regard to economics, cost involved in production was higher under farmer practice (Rs. 106800/ha) and lower under

demonstration (Rs. 102500/ha). Higher cost is mainly due to the indiscriminate use of chemical pesticides for managing pests and diseases under farmers practice. The higher net income (Rs. 201100/ha) and benefit cost ratio (2.96) was realized in demonstration. The lower net income (Rs. 159400/ha) and benefit cost ratio (2.49) was realized in farmers practice. Higher net return is mainly due to the higher bulb yield obtained under demonstration compared to farmers practice. Similar findings of increase in bulb yield and net return by adoption of integrated management practices in onion was reported by Tripathi and Yadav (2019) [15].

Table 3: Bulb yield and economics of small onion as influenced by farming practices

Treatments	Bulb yield (t/ha)	Percent yield increase over farmers practice	Extension gap (t/ha)	Gross Cost (Rs./ha)	Gross income (Rs./ha)	Net income (Rs/ha)	Benefit Cost Ratio
Farmers practice	12.1	-	-	106800	266200	159400	2.49
Demonstration	13.8	14.0	1.7	102500	303700	201100	2.96

Conclusion

From the present study it is concluded that adoption of integrated management practices effectively reduced the pest and disease incidence and enhanced the bulb yield without increasing the cost of production. Hence, onion growers are showing interest in adoption of the demonstrated technological interventions in large scale.

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