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Cluster Demonstration on Integrated Nutrient Management in Dragon Fruit at Farmer Field of Aizawl District Mizoram, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The cluster demonstration of dragon fruit at Muthi & Durtlang Village of Aizawl District has demonstrated under PKVY Programme in the year 2019. A total of 30 farmers were demonstrated for that KVK has provided altogether 1000 nos. of cutting from 2-3 years old strong and dark green healthy (damage free & pest free) and 300 nos. RCC pole 100 mm concrete post with the height of 2 m of selected beneficiaries. Each plant was fed 15-20 kg with organic inputs well decomposed FYM or poultry manure, coir compost and vermicompost along with bio-fertilizers and recommended dose of fertilizer: (500: 300:250 NPK and 100 each of Azotobacter, Phosphate Solubilizing and Potash Solubilizing Bacteria were applied to each plant g/plant/year.) Applied in three doses just before flowering (in April), fruit developing stage (July -August) and after harvesting time (in December).The results revealed that there were significant differences in term of vine length (196.26cm), vine thickness (19.03cm), number of vines per plant (5.98) over the farmers practices which was vine length (182.23cm), vine thickness (17.95cm), number of vines per plant (5.14) The results revealed that there were significant differences over farmer practices as influenced by technology demonstration treatment in both the demonstration year. The

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demonstrated technologies recorded average yield of 8.043 tone/ha which was 18.50 percent higher than the obtained with farmer's practices of 6.787 tone/ha. The demonstrated field gave higher mean gross return (`USD 12763.70 /ha) and mean net returns (`USD 12155.91 /ha) with average benefit cost ratio of 1.14 compared to benefit cost ratio of 1.04 over farmer practices. The findings demonstrated that by implementing suggested technology, broccoli yield and economics can be improved.

Keywords: Cluster demonstration; dragon fruit; manure; fertilizer; biofertilizer; integrated; economic.

1. INTRODUCTION

"The legend of the dragon fruit says that the fruit was created by fire-breathing dragons. By eating the dragon fruit, it was believed that one became empowered with the same strength and ferocity of a dragon. Other stories say that the dragon fruit looks like a dragon's egg. The dragon fruit (*Hylocereus* sp.), is a veining epiphytic Cactaceae family, native to the tropical forest regions of Mexico and Central and South America" [1]. Michael Vanromawia [2] reported that, "dragon fruit cultivation in the state of Mizoram had started with the initiative of Mr. Samuel Rosangliana who was the Director of the Department of Horticulture in Mizoram. They had sent delegates to Israel for training on the cultivation of dragon fruit and the planting material was imported from Thailand".

Fruit has a very attractive colour and mellow mouth melting pulp with black colour edible seed embedded in the pulp, as well as tremendous nutritive value, which attracts growers. It is a climbing vine with a beautiful night blooming flower that is known as "Noble Woman" or "Queen of the Night." The fruit is also known as Pitaya because of the bracts or scales on the fruit skin which meaning ''the scaly fruit. Regarding different uses of Dragon fruit, young stems are edible as well as fresh flower buds that are eaten as vegetables, while dried ones are used for homemade medicine. besides this it is also taken in the form of juice, jam, jelly, ice cream or preserves as well as fresh table fruit. Mizoram is gaining popularity as a commercial crop because of its remunerative cash crops, highly nutritional and medicinal properties believed that its consumption to help in fighting free radicals preventing cell damage & cancer due to rich in phytonutrients which provides sufficient antioxidants. "Dragon fruit are rich in antioxidants It is rich with beta carotene, lycopene, vitamin E vitamin C, phosphorus and calcium helps to develop strong bones, teeth and skin" [1] and "contain essential fatty acids, i.e., 48% linoleic acid and 1.5% linolenic acid in black seeds" [3]. "It is a potential source of betalins for the food industries" [4]. "It is being grown commercially in Israel, Vietnam, Taiwan, Nicaragua, Australia and the United State. The biggest advantage of this crop is that once planted, it will grow for 20 years and one hectare could accommodate 1000 to 2000 dragon fruit plants. It produces fruit in the second year after planting and attain in full production within five years. It is considered as fruit of future" [5] Owing of the wonderful quality of fruit coupled with excellence climatic condition as well as minimal horticultural practices required dragon fruit cultivation in Aizawl District Mizoram is gaining popularity among farming community and Ministry of agriculture and farmers welfare recognized dragon fruit of Aizawl and Kolasib District of Mizoram as 'One district one product'. There are commonly four type dragon fruit grown among of them most imporatat are *Hylocereus undatus and Hylocereus polyrhizus*. (The most common four type's dragon fruit based on their colour are; 1. *Hylocereus undatus*: White flesh with pink skin and many small black seeds. 2. *Hylocereus polyrhizus*: Red flesh with pink skin and many small black seeds. 3. *Hylocereus costaricencis*: Violet red flesh with pink skin and many small black seeds. 4. *Hylocereus (Selenicereus) megalanthus:* White flesh with pink skin and many small black seeds).

Farmers of Mizoram are gaining the much more knowledge about the cultivation of dragon fruit and the area under the dragon fruit will go too increased in future days because of its low requirement of water and minimal tillage practices. But, the information on the use of integrated nutrient management in dragon fruit is scanty. Therefore, the present frontline demonstration was taken up by Krishi Vigyan Kendra Aizawl at farmers filed of tough terrain of Aizawl District Mizoram India to conducted field demonstration of organic practices on growth, yield and economics of dragon fruit in 2018-19 and 2019-20.

2. METHODS AND MATERIALS

The cluster demonstration of dragon fruit at Muthi & Durtlang Village of Aizawl District has demonstrated under PKVY Programme in the year 2019. A total of 30 farmers were demonstrated for that KVK has provided altogether 1000 nos. of cutting from 2-3 years old strong and dark green healthy (damage free & pest free) and 300 nos. RCC pole 100 mm concrete post with the height of 2 m of selected beneficiaries. To prevent diseases especially the rots, cutting was treated with fungicides and cured in a cool, dry area for 5-7 days before planting. The treated cut piece with slanted end of 30-40 cm long and with good eyes, which were covered by strong thorns. Piled up these cutting two days before the planting4 cutting were planted in pit with size 60 x 60 x 60 cm at spacing on 2 m x 2 m these pit media consisted of the top soil (1:1:2) enriched with organic inputs like farmyard manure, poultry manure, coir compost and vermi-compost along with bio-fertilizers. Plant was supported 100 mm concrete post, with the height of 2 m and buried 40 cm for each supporting pole and made sure to cover with soil straw. These cutting was tied properly for vertical growth. Each plant was fed 15-20 kg with organic inputs well decomposed FYM or poultry manure, coir compost and vermicompost along with bio-fertilizers and recommended dose of fertilizer: (500: 300:250 NPK and 100 each of Azotobacter, Phosphate Solubilizing and Potash Solubilizing Bacteria were applied to each plant g/plant/year.) Applied in three doses just before flowering (in April), fruit developing stage (July - August) and after harvesting time (in December). Dragon fruit vines grow quickly and produce thicker, more dense branches in the early stages. The lateral buds and branches were pruned so that they would grow towards the stands. The branches were allowed to grow once the vines reached the top of the stands. The tip of the main stem was removed to allow new shoots to grow laterally and climb at the ring to form an umbrella-like structure of vines from which flowers emanated and developed into fruits, inducing lateral branching [6-8]. Management of orchard and awareness about other good horticultural practices for providing technical guidance from time to time given by KVK scientist to the farmers. The farmers were highly fascinated by the new fruit crop and showed lots of enthusiasm for learning the technical know-how of this fruit crop. The fruit is ready for first harvested within 15-18 months after planting. Generally flowering start in May-June and bear fruit from August to December months. Fruit become ready to harvest after one month flowering. Plant growth and development parameters viz. vine length (cm), vine thickness (cm), number of vines per plant by measuring scale and counting were used for recording the observations; of fruit, Single fruit weight and yield were measured by weighing method, yield was measured by the whole plant. The quantity of fruits was counted. By randomly choosing 10% of the fruits gathered in the experimental plot, the weight of a single fruit was studied.

3. RESULTS AND DISCUSSION

3.1 Growth Attributes

The effects of technology demonstration treatment on the growth attributes parameters are shown in (Table 1) The results revealed that there were significant differences in term of vine length (196.26cm), vine thickness (19.03cm), number of vines per plant (5.98) over the farmers practices which was vine length (182.23cm), vine thickness (17.95cm), number of vines per plant (5.14) The results revealed that there were significant differences over farmer practices as influenced by technology demonstration treatment in both the demonstration year.

Kumar et al. [9] reported that the complete dose of fertilizers integrated of inorganic, organic and biofertilizer might have triggered the maximum potential of photosynthesis in the plants and ultimately producing the higher values in terms of yield related attributes.

S.P. chakma et.al. (2019) and R.C. Lalduhsangi and Debashis Mandal [10] in dragon fruit.

3.2 Yield and Yield Attributes Parameter

The yield characters play an essential role in identifying the treatments that are potential to satisfy the farmer's needs. The technology demonstration results revealed that the yield and yield attributing parameters were significantly influenced in compare to farmers practices (Table 2 & 3).

The results revealed that FLD recorded higher yield as compared to farmer's practices over the two years of study. The demonstrated technologies recorded average yield of 8.043 tone/ha which was 18.50 percent higher than the obtained with farmer's practices of 6.787 tone/ha. In spite of increase in production yield attributed

Table 1. Effect of Technology Demonstration on the average growth parameters of dragon fruits

Year	2018-19 (a)			2019-20 (b)		
Treatment	**Vine length (cm)**	**No. of vine**	**Vine diameter (cm)**	**Vine length (cm)**	**No. of vine**	**Vine diameter (cm)**
Technology Demonstration	95.26	3.01	11.03	196.26	5.98	19.03
Farmers Practices	74.23	2.80	8.83	182.23	5.14	17.95

Table 2. Effect of Technology Demonstration on the yield attributing characters of dragon fruits

Year	2018-19 (a)				2019-20 (b)			
Treatment	**No. of fruit /pilar**	**Fruit weight (g)**	**Fruit size (cm)**		**No. of fruit /pilar**	**Fruit weight (g)**	**Fruit size (cm)**	
			Length	**Breadth**			**Length**	**Breadth**
Technology Demonstration	27	254	9.1	7.2	41.6	274	9.19	7.4
Farmers Practices	20	242	8.2	7.0	31	249	8.4	7.1S

Table 3. Effect of Technology Demonstration on average yield and economic of demonstration on dragon fruit

	Yield (tone/ha)	**% Increase over farmer practices**	**Gross cost USD/ha**	**Gross income USD/ha**	**Net Return USD/ha**	**B:C**
Technology Demonstration	8.043	18.50	12763.70	15371.15	1901.79	1.14
Farmers Practices	6.787		12155.91	12535.78	37.07	1.03

Note: Cost benefit ratio is low due to initial cost of cultivation is high for establishment of orchard especially construction of concrete pillar subsequently it will be increase

parameter also influenced significantly over the farmers practices. P. Roshani et.al. (2019) Reported that "the exogenous application of chemical fertilizers directly shows response on yield attributing factors by increasing the immediate nutrient uptake by plants and showing the response in terms of improved cell division, elongation, vegetative growth and in turn the economic growth. The biofertilizers help to mobilise the nutrients and make them easily available to plants. The integrated application of biofertilizers and inorganic fertilizer might have increased the availability of NPK and also improved the fertility status of soil, that in turn helped the plant in improving the water uptake, proper aeration and productivity due to which yield and its attributing characters might have increased". The experimental findings are in accordance with Vithwel and Kanaujia [11] in carrot, Natalidini et al. [12] in arrow root, S.P. chakma et.al. (2019) and R.C. Lalduhsangi and Debashis Mandal [10] in dragon fruit.

3.3 Economic

The inputs and output prices of commodities prevailed during each year of demonstrations were taken for calculating cost of cultivation, gross return, net return and benefit cost ratio (Table 3). The dragon fruit has a little higher initial establishing cost, particularly when building a trellis, but once the plants are established, fruit can be constantly gathered for up to 20 years. Only minimal costs are necessary to maintain the dragon fruit plantation when the crop is established. [13]. The investment on production by adopting improved technologies with a mean value of USD 12763.70/ha against farmers practices where the cost of cultivation with an average of USD 12155.91/ha. The cultivation of dragon fruit under demonstration technologies gave higher net return of USD 1901.79/ha as compared to USD 37.07 over farmers practices in the corresponding years. The average benefit cost ratio of demonstration technology was 1.14 while farmer's practices calculated 1.01.This may be due to higher yield obtained under improved technologies compared to local check (farmer's practices). This finding is in corroboration with the finding of Mokidue et al. [14], Tomar [15], Balai et al. [16].

4. CONCLUSION

The present study concluded that cluster demonstration on integrated nutrient management in Dragon Fruit at farmer field of Aizawl District Mizoram, India. The findings revealed the possibility of improving broccoli yield and economics through the use of suggested technology.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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