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Influence of different feeding methods of NPK and Boron on fruit yield and economic feasibility of newly planted dragon fruit (*Hylocereus costarecencis*)

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Abstract
The present study was conducted to assess the impact of water soluble NPK and Boron on fruit yield and economic attributes of newly planted dragon fruit. The application of water soluble NPK and boron per pillar containing three plants were applied for all the treatments by two feeding methods during I year and II year. The experiment trial comprises nine treatments *viz*. T_1-Control, T_2-200 g NPK, T_3-200 g NPK (50% main roots +50% aerial roots), T_4-300 g NPK, T_5-300 g NPK (50% main roots +50% aerial roots), T_6-200 g NPK + 0.5% Boron, T_7-200 g NPK + 0.5% Boron (50% main roots +50% aerial roots), T_8-300 g + 1% Boron, T_9-300 g NPK + 1% Boron (50% main roots +50% aerial roots) in simple Randomized Block Design with three replications. There was significant difference during second year in terms of fruit yield and economics of dragon fruit influenced by water soluble NPK and boron. The highest number of fruits per pole (14.0), fruit yield kilogram per pole (3.91), cost of cultivation (Rs.72937), grass return (Rs.329418), net return (Rs.256481) and benefit cost ratio (4.52) were found with the treatment of T_9 during second year. Dragon fruit is a highly potential and is remunerative on second year and onwards.

Keywords: Water-soluble NPK, boron, fruit yield, economics, remunerative, dragon fruit

1. Introduction

Dragon fruit is an herbaceous perennial climbing cactus that belongs to the family cactaceae and the chromosome number is 2n=22. It is originated from tropical and subtropical forest regions of Mexico and Central South America (Mizrahi and Nerd, 1996) [1]. It is commonly known as Kamalam in India and Pitaya, Strawberry pear, Night blooming cereus, Queen of night, Honorable queen, *Cereus triangularis*, Jesus in the cradle and Belle of the night (Martin *et al.* 1987) [2]. It is a highly potential and newly introduced exotic fruit crop in India. Dragon fruit has received worldwide recognition as a fruit crop and as well as an ornamental plant. It is a fast-growing perennial climber which requires vertical support to grow. The stem is a succulent with many-branched segments on it. The stem section of pitaya forms aerial roots which adhere to the surface upon the trellis. The edible portion of the fruit is white and red, studded with numerous edible tiny black soft seeds. The fruit is round to oblong in shape, with red, or yellow-coloured skin with green scales. In India, Gujarat, Karnataka and Maharashtra are the leading producers contributing about 70% of India's dragon fruit production. Dragon fruit production increased drastically to more than 12,000 MT over an area of 3,000-4,000 ha in 2020. The productivity of dragon fruit in India is reported to be 8.0-10.5 (MT/ha) (Wakchaure *et al.,* 2020) [3]. Dragon fruit is highly valued in the fields of healthcare, food processing, nutraceutical, and *cosmeceutical* industries. Its consumption has immunity-building properties and it increases blood cells, and helps in fighting against respiratory diseases, helps in healing cuts and wounds. It is rich in flavonoids that act against cardio-related diseases. It is low in calories and rich in vitamins, minerals and other nutrients.

The red flesh species i.e., *Hylocereus costaricensis* are additionally rich in betalains, meeting the increasing trade interest for antioxidant products and natural food colorant.

Poor soil fertility is the major problem which causes lower production and there is limited information on the interrelationship between soil properties and dragon fruit productivity. The recommendation of fertilizer rates varies widely. Available reports indicate that the crop must be fertilized frequently in the early growth phase. Dragon fruit requires judicious amount of fertilizer for higher yields. Red Pitaya has recently drawn much attention among the Indian growers, not only because of its attractive red or pink color and economic value as fruit. Due to high demand both in domestic and international markets, dragon fruit production could be an economical avocation to both backyard growers as well as entrepreneurs of medium and large-scale plantations. Application of NPK and Boron as well as different feeding methods helps in maintaining soil fertility and sufficient amount of nutrients necessary for better growth and development of plant. Boron plays an important role for nucleic acid and lignin synthesis, proper development of ovule, pollen tube growth and increases, well number of fruit set. It is associated with translocation and transformation of sugars. For commercial exploitation of this crop, it is necessary to know that crop yield and their economics of dragon fruit cultivation in North India.

2. Material and Methods

The present investigation on effect of water soluble NPK and boron on fruit yield and economic feasibility in newly planted dragon fruit. The experiment was conducted at Main Experimental Station, Horticulture, A.N.D.U.A.&T., Kumarganj Ayodhya, Uttar Pradesh, India during the year 2021-22 and 2022-2023. Geographically, this area situated in typical saline alkali belt of Indo- gangetic plains of eastern U.P. at 26.47 N latitude, 88.12°E longitudes and at an altitude of 113 meter from mean sea level. The region enjoys sub-humid and subtropical climate receiving a mean annual rainfall of about 1215 mm out of which about 85% is concentrated from mid-June to end of September with an average annual rainfall of 764.01mm and relative humidity of 66.76 percent. The soil texture of the experiment field was silt loam with pH 8.3, organic carbon 0.22%, available nitrogen 126.5 kg/ha, P_2O_5 15.26, K_2O 240 kg/ha and boron 0.32 ppm. Fifty percent of the pole was wrapped in green net that was 10 cm thick with coco-peat, and the other 50 percent was merely covered in green net. Three-month-old healthy plants were planted on 22 January 2021 at the distance of 4x3 m around the pole. Each pillar has three plants placed on it from 15 cm apart from the pole. The experimental design was randomized block with nine treatments of different combination of water soluble NPK and boron T_1-Control, T_2-200g NPK, T_3-200 g NPK (50% main roots +50% aerial roots), T_4-300g NPK, T_5-300g NPK (50% main roots +50% aerial roots), T_6-200g NPK + 0.5% Boron, T_7-200g NPK + 0.5% Boron (50% main roots +50% aerial roots), T_8-300g + 1% Boron, T_9-300g NPK + 1% Boron (50% main roots +50% aerial roots) were applied in 6 and 3 instalments with different feeding methods, respectively. The first imposition was carried out in February 2021 at initiation of shoot, and then each application was made in alternate month until flowering and fruiting. The yield and economic feasibility of dragon fruit *viz.* total number of fruits per pole, fruit yield kg/pole, gross return Rs per acre, net return Rs per acre and cost benefit ratio was noticed during the investigation.

2.1 Number of fruits per pole: The annual production of fruits per pole was counted first fruit to last fruit counted and expressed in number of fruits per pole.

2.2 Fruit yield (Kg/poles): The annual production of fruit weight was measured through physical balance and the weight of fruits per pole was calculated in kilogram.

2.3 Cost of cultivation (Rs. acre^{-1}): The cost of cultivation of dragon fruit (treatment-wise) was calculated separately by adding the value of each input i.e., labour charges, cost of plants and poles, cost of fertilizers etc. in each treatment during the experimental period.

2.4 Gross income (Rs. acre^{-1}): The yield of dragon fruit (treatment-wise) was converted into gross income based on the prevailing market price.

2.5 Net income (Rs. acre^{-1}): The net income was calculated for each treatment by deducting the cost of production from the gross income obtained in each treatment.

2.6 Benefit: Cost ratio: The Benefit: Cost ratio of different treatments was calculated by dividing the grass income by the respective cost of cultivation of different treatments using the following formula.

$$\text{Benefit: Cost ratio} = \frac{\text{Gross income (Rs. acre}^{-1}\text{)}}{\text{Cost of cultivation (Rs. acre}^{-1}\text{)}}$$

2.7 Statistical analysis

Obtained data were analysed, as suggested by Gomez and Gomez (1984) [4] with the help of Statistics 10 software and presented in Table 1.

3. Results and Discussion

3.1 Number of fruits per pole

Two years data in the table-1 found that treatment effect was very less in first year and no significant bearing of fruit was noticed by the plant. In second year, number of fruits was significantly influenced by the treatment application of water soluble NPK in individual or in combination with the boron along with different feeding methods. The maximum number of fruits per pole were recorded (14.0) in treatments T_9-300g NPK + 1% Boron (50% main roots +50% aerial roots), which was at par with T_5 and T_8. While the minimum fruiting per pole were recorded under T_1 Control. It may be due to sufficient supply of nutrients through water soluble NPK and boron favourably effects on the proliferation of roots and thereby increasing the uptake of the plant nutrients from the soil, aerial roots and ultimately the plant growth and number of fruits. The present results are close conformity with findings of Hoe (2014) [5] and Siddiqua, A. (2021) [6] in dragon fruit.

Table: 1: Effect of different feeding methods of NPK and boron on number of fruits per pole and fruit per kg/poles of newly planted dragon fruit

Treatments	Number of fruits per pole		Fruit yield kg/ poles	
	I year	II year	I year	II year
T_1	1.00^b	5.33^c	0.12^c	0.74^e
T_2	1.33^b	8.33^b	0.27^{bc}	1.75^d
T_3	1.67^{ab}	9.33^b	0.34^{bc}	2.03^d
T_4	1.67^{ab}	12.33^a	0.39^{abc}	3.04^c
T_5	2.00^{ab}	13.00^a	0.48^{ab}	3.37^{bc}
T_6	2.00^{ab}	8.00^b	0.44^{ab}	1.80^d
T_7	1.33^b	9.00^b	0.31^{bc}	2.09^d
T_8	2.00^{ab}	13.33^a	0.48^{ab}	3.61^{ab}
T_9	2.67^a	14.00^a	0.66^a	3.91^a
LSD ($p \leq 0.05$)	NS	1.7	NS	0.36

*****NS= non-significant

3.2 Fruit yield kg/pole

Two years pertaining data in the table-1 indicated that fruit yield was very less in first year and no significant yield was observed. During the second-year, yield was significantly influenced by the application of water soluble NPK in individual or in combination with the boron as well as different feeding methods. The maximum fruit yield (kilogram) per pole was recorded (3.91) in treatments T_9-300g NPK + 1% Boron (50% main roots +50% aerial roots) which was statistically at par with T_8. While the minimum fruit yield per pole were recorded under T_1 Control. This might be because of balanced nutrition application in yield target approach which increases the uptake of essential nutrients and accelerates the activities of cell elongation and cell multiplication as well as metabolic activities resulted in increasing all the growth attributes of fruit. Similar results were recorded by Pacharne *et al*. (2016) [7] and Shreenivasa *et al*. (2017) [8]

3.3 Cost of cultivation (Rs/acre)

Two years data on cost of cultivation is (presented in Table 2 and fig.1) divided into two categories: fixed and variable costs. The fixed cost was consistent across all the treatments however, the variable cost varies due to amount of fertilizer among the treatments. The highest cost of cultivation of both year (Rs.281305/acre I year and Rs.72937/acre II year) was determined in T_9-300g NPK + 1% Boron (50% main roots +50% aerial roots), while the minimum cost of cultivation of both year (Rs.241440 I year and Rs.31072 II year) was calculated with T_1 control. The variation in the cost of cultivation was due to different combinations and prices of inputs *viz*. labour charges, cost of plants and poles, cost of fertilizers etc.

3.4 Gross return (Rs/acre)

Two years data (presented in the table-2 and fig.1) revealed that no gross return was found in first year among all the treatments, on second year grass return was significantly influenced by the application of water soluble NPK in individual or in combination with the boron as well as different feeding methods. The maximum gross return was recorded (Rs.329418/acre) in treatments T_9-300g NPK + 1% Boron (50% main roots +50% aerial roots), while the lowest gross return (Rs.49876/acre) was calculated with T_1 control. It is might be due to having commercial yield in second year and onwards.

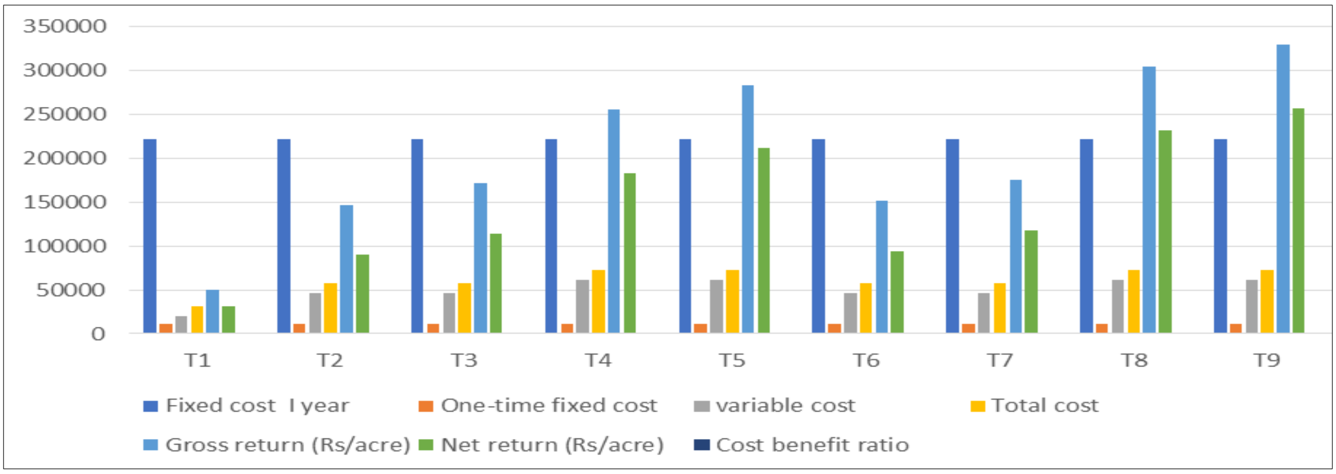
Table 2a: Effect of different feeding methods of NPK and boron on the economics of newly planted dragon fruit (I Year)

Treatment	I Year					
	Cost of cultivation (Rs/acre)			Gross return (Rs/acre)	Net return (Rs/acre)	Cost-benefit ratio
	Fixed cost	variable cost	Total cost			
T_1	221440	20000	241440	-	-	-
T_2	221440	44200	265640	-	-	-
T_3	221440	44200	265640	-	-	-
T_4	221440	59365	280805	-	-	-
T_5	221440	59365	280805	-	-	-
T_6	221440	44450	265890	-	-	-
T_7	221440	44450	265890	-	-	-
T_8	221440	59865	281305	-	-	-
T_9	221440	59865	281305	-	-	-

* Since there was no commercial yield in the first year so that there was no gross return, net return, etc.

3.5 Net returns (Rs/acre)

Two years data (presented in the table-2 and fig.1) indicated that no net return was found in first year among all the treatments, on second year the net return was significantly influenced by the application of water soluble NPK in individual or in combination with the boron as well as different feeding methods. The maximum net return was recorded (Rs.256481/acre) in treatments T_9-300g NPK + 1% Boron (50% main roots +50% aerial roots), while the lowest net return (Rs.18804/acre) was calculated with T_1 control. It is might be due to having gross return in second year and onwards.



*Average annual expenditure (fixed): Taking the average productive life of dragon fruit orchard 20 years: 221440/20=11072 Rs per year.

Fig 1: Effect of water-soluble NPK and boron on the economics of dragon fruit after transplanting (II Year)

3.6 Benefit cost ratio Two years data (presented in the table 2 and fig.1) revealed that the benefit: cost ratio was neither in first year. In second year significantly influenced with more benefit by the application of water soluble NPK in individual or in combination with the boron as well as different feeding methods. The maximum cost benefit ratio was recorded (4.52) in treatments T_9-300g NPK + 1% Boron (50% main roots +50% aerial roots), while the minimum cost benefit ratio (1.60) was calculated with T_1 control. The yield and market price are a major factor which cause a differences in gross return per rupees invested (B: C ratio). Similar findings also reported by Nangare *et al*. (2020) [9] in dragon fruit, Singh *et al*. (2014) [10] in ber and Jain *et al*. (2010) [11] in guava.

4. Conclusion

The results of this study reveal our routes towards prescribed water soluble NPK and boron for better yield and benefit-cost ratio of dragon fruit. Among all the treatments, T_9-300g (50% basal+50% aerial roots) Water soluble NPK + 1% Boron was best in respect with fruit yield and economic feasibility of dragon fruit. Based on these findings, it is recommended that reliable for commercial production of Dragon fruit, as it is quick response in economic benefits. According to the benefit-cost ratio, small and marginal farmers could achieve popularity with economic performance to doubling the income by growing dragons.

5. References

1. Mizrahi Y, Nerd A. New crops as a possible solution for the troubled Israeli export market. Wanatca Yearbook. 1996;20:41-51.
2. Martin FW, Camel CWA, Ruberte RM. Perennial edible fruits of the tropics: an invention. ARS Series: Agriculture Hand book, Mayaguez, Puerto Rico; c1987. p. 65-4612.
3. Wakchaure GC, Satish Kumar, Meena KK, Rane J, Pathak H. Dragon Fruit Cultivation in India: Scope, Marketing, Constraints and Policy Issues. Technical Bulletin No. 46. ICAR–National Institute of Abiotic Stress Management, Baramati, Pune, Maharashtra, India; c2020. p. 54.
4. Gomez KA, Gomez AA. Statistical procedure for Agricultural research. II Ed, Wiley and Sons, New York; c1984. p. 28-192.
5. Hoe TK. Effect of compost application to improve the red pitaya yield under various mixture fertilizers rates. Acta Hort; c2014. p. 1024.
6. Siddiqua A. Studies on the influence of organic manures and bio-fertilizers on plant growth, yield, quality and storage of dragon fruit (*Hylocereus undatus* and *Hylocereus polyrhizus*)¨ Ph.D. thesis., UAS, GKVK, Bangalore; c2021.
7. Pacharne DP, Tumbare AD. Effect of nutrient management on growth, yield and quality of Kharif groundnut. International Journal of Agricultural Sciences. 2016;12(2):163-166.
8. Shreenivasa BV, Ravi MV, Latha HV. Effect of targeted yield approaches on growth, yield, yield attributes and nutrient uptake in maize (*Zea mays* L.)- chickpea (*Cicer arietinum* L.) cropping sequence in UKP command area of Karnataka. An Asian Journal of Soil Science. 2017;12:143-150.
9. Nangare DD, Taware PB, Singh Y, Kumar PS, Bal SK, Ali S, *et al*. Dragon Fruit: A Potential Crop for Abiotic Stressed Areas. Technical Bulletin No. 47. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, Maharashtra, India; c2020. p. 24
10. Singh JK, Singh DK, Singh HK. Integrated nutrient management studies on yield, physico-chemical characteristics and economic feasibility of bael (*Aegle marmelos* Correa) cv. NARENDRA BAEL-9. Asian Journal of Horticulture. 2014;9(2):342-346.
11. Jain MC, Chaudhary HD, Sharma MK, Bhatnagar P, Gupta NK. Effect and Economic Feasibility of Plant growth regulators on yield of Nagpur Mandarin. I.J.A.B.R. 2015;5(1):1-4.