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Research Article

EFFECT OF FOLIAR APPLICATION OF NAA ON FRUITING AND YIELD OF SUMMER SEASON CHILLI (*Capsicum annuum* L.)

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Abstract: The experiment was conducted to find out the effect of foliar application of α-NAA on fruiting and yield of chilli (*Capsicum annuum* L.) during 2021 and 2022 at Alwar, Rajasthan. Foliar application of plant growth regulator Naphthalene acetic acid (NAA) @ 10 ppm at 45 and 60 days after transplanting (DAT) recorded maximum fruit retention (39.58/plant) and higher yield of green chilli (130 q/ha) as compared to fruit retention (36.31/Plant) and yield (117.5) recorded in control (farmer's practice). There was 9.01% increase in fruit retention / plant and 10.64% increase in yield over control. The technology gap in productivity (20 q/ha) was computed. The Technology index value (13.33%) was recorded. By conducting on-farms testing of proven technology of foliar application of α NAA, yield potential of chilli can be increased.

Keywords: *on-farm testing, Chilli, Plant growth regulator, α NAA*

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Introduction

In India area and production of green chilli were 364000 hectare and 3720000 metric tonnes respectively during 2018-19 [1]. The production of chilli is governed not only by the inherent genetic yield potential of the cultivars but it is greatly influenced by several environmental factors and cultivation practices. The production of chilli is reduced due to flower and fruit drop, which is caused by physiological and hormonal imbalance in the plants particularly under unfavorable environment, such as extremes of temperature *i.e*., too low, or high temperature [2]. If temperature goes above 37°C, development of fruits is affected. Temperature higher than 40°C & lower than 10°C causes fruit drop. This may be due to hormonal imbalance which results into lower level of plant growth promoter auxin and higher level of plant growth inhibitor abscisic Acid (ABA). ABA causes development of abscission layer at the point of attachment of flower & fruits, stops supply of nutrients and water that causes fruit drop. Studies on the effect of plant growth regulators in solanaceous vegetable crops have revealed that the application of some of the plant growth regulators has been found effective in reducing the flower and fruit drops thereby enhancing production of chilli per unit area and per unit time. The varying responses of chilli to plant growth regulators [3]. Plant growth regulators are considered as new generation of agro-chemical after fertilizer, pesticides & herbicide to augment seed yield & quality. Hence, to popularize the use of NAA among farmers an on- farm testing was conducted.

Material and Methods

An on-farm testing was conducted in Alwar district to see the effect of foliar application of α NAA on fruiting and yield of summer season chilli during 2021 and 2022 at 10 farmer's yield. Soils of experiential fields were sandy loam in texture, medium in nitrogen, phosphorus & potash with saline reaction. Seeds were sown on 10th February in nursery. In both the treatments (farmer's practice & demonstration) recommended doses of fertilizers- NPK @ 70: 48: 50 were applied and other cultural practices were common. In the treatment T_2 (technology demonstration) foliar application of α NAA @ 10 ppm at 45 and 60 DAT was also done additionally. The inorganic fertilizer was applied in the form of urea, diammonium phosphate and muriatic of potash. The full dose of phosphorus and potassium were applied as basal application at the time of transplanting and nitrogen equally in four splits as basal, 30,60,90 days after transplanting. Weed management and need based plant protection chemicals were applied.

The data on numbers of fruits/plant, cost of cultivation, production, productivity, total return, and net return were collected in both treatments as per schedule. Average of cost of cultivation, yield and net returns were analyzed by formula.

Average = [F_1+ F_2+F_3.....Fn]/N

Where, F_1 = Farmer

N = Number of farmers

Technology index was operationally defined as the technical feasibility obtained due to implementation of demonstration (on- farm testing) in fennel. To estimate the technology gap, extension gap and technology index following formula was used [4].

Technology gap = Pi (Potential yield) - Di (Demonstration yield)
Extension gap = Di (Demonstration Yield) - Fi (Farmers yield)
Technology Index = [(Potential yield - demonstration yield) / Potential yield] X 100

Results and Discussion

Performance of on farm testing

The foliar application of α NAA @ 10 ppm at 45 and 60 days after transplanting recorded the retention of maximum number of fruits (39.5/plant) than farmer's practice (36.31/plant). The percentage increase in fruit retention per plant (9.01%) over farmer's practice was recorded. This treatment recorded the higher yield (130 q/ha.) than farmer's practice (117.5 q/ha). The percentage increase in the yield (10.64%) over farmer's practice was recorded. The application of plant growth promoter NAA exhibited significant influence on fruits retention & yield. NAA is synthetic hormone of auxin group. Plant growth regulators are synthetic substance which in very small quantity influence the growth and other physiological functions of the plant.

In the period from May to June Maximum temperature was recorded more than 38°C that probably caused the imbalance of hormones. At higher temperature lower internal auxin and higher Abscisic acid might have caused formation of abscission layer which caused flower & fruits drop.

Table-1 Yield, technology gap, extension gap and technology index

Variable	No. of fruits/ plant	Change in parameter	Yield (q/ha)	Increase over farmers' practice (%)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
T_1. Farmer's practice	36.31		117.5	-	-	-	-
T_2. The foliar application of α NAA @ 10 ppm at 45 and 60 days after transplanting	39.58	9.01	130	10.64	12.5	20	13.33
Additional in T_2 treatments application			12.5				

Table-2 Economics (average of 2 years) of chilli production under on-farm testing

Technology option	Yield q/ha)	Cost /ha (₹)	Gross return ₹/ha	Net return ₹/ha	Benefit : cost ratio
T_1. Farmer's practice	117.5	79,450	2,11,500	1,32,050	01:02.7
T_2 - The foliar application of α NAA @ 10 ppm at 45 and 60 days after transplanting	130	80,950	2,34,000	1,53,050	01:02.9
Additional in T_2 treatment application	12.5	1,500	22,500	21,000	* 14

The growth promoter like NAA is known to involve in the initiation of cell division in the cambium, inhibition of cellulose and pectinase activities and abscisic acid production which might have reduced the premature flower drop apart from involved in ovary development during seed filling process [5] in chilli. Similar beneficial effect of growth regulators on fruit setting percentage were reported in chilli [6]. The plant growth regulators are known to enhance the photosynthetic rate adding better shoot, root growth & the source sink relationship & stimulate the translocation of photo assimilates thereby helping the better retention of flowers & fruits. Besides this, the growth promoters can cause accelerated growth in plants.

Plant sprayed with growth regulators remained physiologically more active to build up sufficient food reserve (source) for developing flowers and fruits (sink) [7]. NAA might be responsible for increase in photosynthetic activities within the plant which might be resulted in more production of carbohydrates and related products responsible for increase in growth and yield of chilli [8] . [9] observed that yield attributing parameters as well as seed yield and quality of chilli were better with the application of NAA compared to control.

The results consonance with Revanappa (1998) reported that Similarly fruit yield per plant were obtained maximum when 20 ppm NAA was sprayed after transplanting compared to control in chilli [5]. Pundir, *et al*., (2020) [10] reported application of NAA for better growth and yield of chilli. The highest fruit yield (779.52 q/ha.) in tomato with 10 ppm NAA [11]. Similar findings were reported by other researchers [12-17]. Thus, it is evident that performance of technology tested was found to be better than the farmer's practice under the same environmental conditions. The farmers were motivated by seeing the results in term of productivity and they are adopting the technology. The yield under on-farm testing and potential yield of crop was compared to estimate the yield gaps which were further categorized into technology index and technology gap.

The technology gap showed the difference between potential yields over demonstration (on- farm testing) yield of the technology. The potential yield of the variety is 150 q/ha. The Technology gap 20 q/ha was recorded. The on-farm testing was laid down under the supervision of Krishi Vigyan Kendra's specialists at the farmers' field, there exist a gap between the potential yield and demonstration yield.

This may be due to the soil fertility and weather condition. Comparative high extension gap (12.5q/ha) indicates that there is need to educate the farmers and help them for optimizing the yield by adopting improved practices. More use of improved technologies by the farmers will subsequently change existing trend of extension gap. Technology index shows the feasibility of technology at farmers' field. The lower value of technology index, more is feasibility of particular technology. The result revealed that technology index value value13.33 [Table-1]. It means the technology is suitable for Alwar district of eastern Rajasthan.

Conclusion

The economic analysis of chilli production revealed that treatment T_2, foliar application of NAA @ 10 ppm at 45 and 60 days after transplanting recorded higher gross return (Rs.₹ 2,34,000 /ha) and net return (₹ 1,53,050/ha) with higher benefit: cost ratio (1:2.89) as compared to farmer's practice. These results are in accordance with findings of other workers [18]. An additional cost of ₹1,500/ha has increased additional net return ₹21,000/ha with incremental benefit : cost ratio 14 suggesting higher profitability and economic viability [Table-2].

Application of research: Study of effect of NAA to reduce flower and fruit drops in summer season

Research Category: Fruiting and Yield

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Study area / Sample Collection: Alwar

Cultivar / Variety / Breed name: Chilli (*Capsicum annuum* L.)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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