

Effect of Naphthalene Acetic Acid (NAA) on Growth and Yield Attributing Characteristics of Chilli (*Capsicum annum L.*)

ABSTRACT

Chilli (*Capsicum annum L.*) is one of the most valuable spice crops. It is widely used in many cuisines as a spice to add hot flavour to dishes and sauces. The production of chilli is affected by several factors governed not only by the inherent genetic factors but also by several environmental factors and management practices. Therefore, Krishi Vigyan Kendra, Maulasar, Nagaur-II, Rajasthan (Agriculture University, Jodhpur, Rajasthan, India) initiated to conduct On Farm Testing (OFT) for assess the effect of Naphthalene Acetic Acid (NAA) on growth and yield Attributing characteristics of chilli. The present OFT was carried out at 20 farmers fields of Nagaur district of Rajasthan under supervision of KVK, Nagaur-II, Rajasthan during Zaid season of two consecutive years i.e., 2020-21 and 2021-22. The pooled data of both the years indicated that the foliar spray of naphthalene acetic acid @ 20 PPM increased plant height (70.45 cm), number of branches/plant (14.15), fruit set (49.42%), fruit length (8.40 cm), fruit weight (3.65 g), number of fruits/plant (133.55), fruit yield (292.50 q/ha), net return (₹ 345100) and benefit cost ratio (4.68) as compared to farmers practices (no use of PGR). It is also observed that days taken to first harvest was almost two weeks earlier with the spray of NAA. It was 84.50 days after transplanting in treatment (NAA @ 20 PPM) whereas; it was maximum (97.35 days) in control.

Keywords: Chilli, Growth, Economics, NAA, On Farm Trial, Yield.

INTRODUCTION

Chilli (*Capsicum annum L.*) is an important condiment and cash crop grown throughout the country. It is reported to be a native of South America and is widely distributed in all tropical and sub-tropical countries. It belongs to the family Solanaceae and has chromosome number $2n=24$. It is an important vegetable and spice which is used in India as a principal ingredient in Indian cuisine. The main functional properties of chilli are pungency, antioxidant activity, vitamin C and natural pigments. The chilli

fruit pungency is due to alkaloid capsaicin (Parthasarathy *et al.*, 2008) and its bright red colour is due to the pigment capsanthin. Pungent forms are used as green chilli, whole dry chilli, chilli powder, chilli paste, chilli oleoresin, chilli sauce or as mixed curry powder. In food and beverage industries chilli is being used in the form of oleoresin which permits better distribution of colour and flavour in food.

The production of chilli is not only governed by the cultivars but it is notably influenced by a number of environmental factors and agriculture practices. Reduction in chilli yield is also observed due to drop of flower buds, flowers and young fruits, which is caused by physiological and hormonal imbalance in the plants particularly under unfavourable environments, such as extremes of temperature (Shil and Nath, 2016). Fruit set in crops can be increased by applying plant growth regulators to compensate for the deficiency of natural growth substances required for its development (Singh and Choudhary, 1966). NAA improves the internal physiology of plants in terms of better supply of water, nutrients and other bio-compounds vital for their proper growth and development (Meena and Dhaka, 2003; Khurana *et al.*, 2004). The beneficial effect of growth promoters like NAA on physiological processes of plants leads to accumulation of carbohydrates and minerals in different parts of the plants and thus resulted in the production of a greater number of branches and leaves (Tamilselvi and Vijayaraghavan, 2014). The advantageous effects of different plant growth regulators on vegetables have been studied judiciously but the work on chilli is scanty. Therefore, the present study was undertaken to find out the effect of NAA on the growth and yield of chilli under hot arid conditions of Rajasthan.

MATERIAL AND METHODS

The On-farm Trail was conducted for two consecutive years *i.e.*, 2020-21 and 2021-22 during *Zaid* season at twenty farmers' fields in different villages *viz.*, Maulasar, Ladriya, Bedwa, Dhankoli, Nangwada and Rashidpura of Nagaur district of Rajasthan. The treatments comprised of T₁-Farmers' practice (Control- No spray) and T₂- Foliar spray of NAA @ 20 PPM. The area of experiment plots was 0.1 ha of each farmer. The field was thoroughly ploughed and well decomposed farmyard manure (20t/ ha) was applied. Drip system for irrigation and silver black plastic mulch were laid on raised beds of 3ft wide and 1ft high with 2ft wide furrows. After laying the film, small circular holes were made with scissors as per the 90 x 45 cm spacing (Inter row spacing x Intra row spacing of the crop) in paired row system. Forty five days old

seedlings of chilli was transplanted in the last week of January to mid-February at 90 x 45 cm spacing. Transplantation was done during evening time and watering was done immediately after transplantation. Further irrigation was done as per necessary. All the intercultural operations were followed timely in the experimental site as per the requirement of the crop. All the nutrient management and plant protection measures were followed as per the recommended package of practices for Zone IIa. NAA (20 PPM) was imposed as foliar spray at 30 and 45 DAT by using knapsack sprayer.

The observations recorded on plant height (cm), number of branches, fruit set (%), days to 50 % flowering, days to first harvest, fruit length (cm), fruit weight (g), no of fruits/plant and yield/hectare. The mean data of all the observation over two years were pooled. Cost of cultivation (Rs/ha) was calculated considering the prevailing charges of agricultural operations and market price of inputs involved. Gross returns were obtained by converting the harvest into monetary terms at the prevailing market rate during the course of studies. Gross return (Rs/ha) = (fruit yield/ha) x price, net returns were obtained by deducting cost of cultivation from gross return. The benefit: cost ratio was calculated by dividing gross returns (Rs/ ha) and cost of cultivation (Rs/ha).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following heads:

Growth, Quality and Yield Parameters

The result of present study (Table 1) clearly indicate that plant height, number of branches/plant, fruit set, days to 50% flowering, fruit length (cm), fruit weight (g), no. of fruits/plant and green fruit yield were increased by the application of naphthalene acetic acid @ 20 PPM as compared to farmer's practices (control).

The maximum plant height (70.45 cm) was recorded in treatment T₂ (NAA @ 20 PPM) than control (55.80 cm). The promoting effect on plant height by the application of NAA might be due to its action as a group of auxins. The cell wall probably reacted favourably and high deposition of cell wall material took place due to high catalysing activities of carbohydrates and pectolase. NAA improves the internal physiology of plants in terms of better supply of water, nutrients and other biocompounds vital for their proper growth and development (Shil and Nath, 2016; Shankhwar *et al.*, 2017). Highest number of branches/plants (14.15) was observed with the spray of NAA @ 20

PPM, whereas; it was lowest (10.45) in control. NAA treatment might be attributed to the activation of cell division and cell elongation in the axillary buds, which had a promoting effect on increased number of primary branches. These results are in collaboration with the findings of Shil and Nath (2016) and Kumari *et al.* (2016) in chilli. Similarly; maximum fruit set (49.42%) was recorded with treatment NAA (20 PPM) and it was only 28.61 % in control. The minimum days to 50% flowering (50.80) was recorded in T₂ (NAA 20 PPM) whereas it was 57.02 days in control conditions. These results are in agreement with the findings of Choudhary *et al.*, (2013) in chilli.

Table 1: Effect of Naphthaleic Acetic Acid (NAA) on Growth, Yield and Quality of Chilli

Treatments	Plant height (cm)	No. branches/plant	Fruit set (%)	Days to 50% flowering	Days to first harvest	Fruit length (cm)	Fruit weight (g)	No of fruits/plant	Green fruit Yield/ha
T ₁ - Control (No spray)	55.80	10.45	28.61	57.02	97.35	7.01	2.81	92.8	207.50
T ₂ -NAA @ 20 PPM	70.45	14.15	49.42	50.80	84.50	8.40	3.65	133.55	292.50

From presented data in Table 1 it can be concluded that NAA @ 20 PPM has a positive effect on early fruit harvest. It is recorded that initiation of flowering was almost two weeks earlier with NAA. It was 84.50 days after transplanting in treatment (NAA @ 20 PPM), whereas; it was 97.35 days in control. Farmers consider the earlier harvest time a significant advantage, as it improves profitability. Early flowering in chilli may be due to the increased synthesis of cytokinin and auxin in the root tissue by their enhanced activity due to the application of NAA. Their simultaneous transport to the axillary buds would have resulted in a better sink for the mobilization of photo assimilates at a faster rate. This has helped in the early transformation from the vegetative phase to reproductive phase (Tapdiya *et al.*, 2018). The fruit length and weight of chilli was found higher with application of NAA. It was 8.40 cm and 3.65 gm, respectively, whereas it was 7.01cm and 2.81gm, respectively in control condition. It might be attributed that NAA sprayed plants contain higher chlorophyll content as it is known to increase chlorophyll. Chlorophyll aids in higher photosynthetic rate resulting in more carbohydrate synthesis ultimately increasing the length and weight of fruit. Simultaneously, yield (no of fruits/plant and yield/ha) was also found higher in plants sprayed with NAA (20 PPM). It was 133.55 and 292.50 g, respectively for no. of fruits and yield/ha, whereas; it was 92.8 and 207.50 g, respectively for these parameters in control conditions. 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, fruit size, and fruit weight of chilli, ultimately responsible for increased yield of chilli (Mahindre *et al.*, 2018 and Tapdiya *et al.*, 2018).

Economic Performance

Farmers accept new technology when it is economically viable, and it depends on the benefit cost ratio. Therefore, it is required to know the economics of the experiment as no technology can be suggested while not knowing its profit and loss. The input and output prices of commodities prevailed during the year of investigation were taken for calculating cost of cultivation, net returns and benefit cost ratio. Net profit /ha also depends upon the availability of labour and a suitable market for the disposal of produce. It can be seen from Table 2 that the highest cost of cultivation was ₹ 93650 in T₂ (Foliar spray of NAA @ 20 PPM), whereas; it was lowest (₹ 90950 in control. The extra expenditure was incurred because of the spray of naphthalene acetic acid (NAA). Highest net return (₹ 345100) was obtained in treatment of foliar spray of NAA as compared to control or no use of growth regulator. Higher gross return (₹ 438750) and benefit cost ratio (4.68) were also recorded in T₂, whereas, it was lowest in farmers practices. The results obtained in the present investigation are in close conformity with the findings of Anbarasi and Venkatraman (2022) and Kumari *et.al.*, (2017) in chilli crop.

Table 2. Effect of Naphthalene Acetic Acid (NAA) on Economics of Chilli

Treatments	Cost of cultivation (₹ /ha)	Gross return (₹ /ha)	Net return (₹ /ha)	B:C ratio
T₁- Farmer's Practice (No Spray)	90950	3,11,250	220300	3.42
T₂- NAA (20 PPM)	93650	4,38,750	345100	4.68

CONCLUSION

It increases the yield of chilli with the higher output attributed to proper plant growth, management of the abscission layer in full bloom and acceleration of full development by beneficial hormonal effects. To compare the effect of foliar NAA treatment, data on blossom drop, growth, and yield contributing characteristics were recorded and averaged. It is concluded from this OFT that the treatment T₂ *i.e.*, application of 20 PPM Naphthalene-1-Acetic Acid (NAA) was found superior in terms of different growth attributes, *viz.*, plant height, number of branches, fruit set, days to 50% flowering, days to first harvest, fruit length, fruit weight, number of fruits per plant and yield /ha.

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