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EFFECT OF FERTILIZER AND IRRIGATION ON THE YIELD AND YIELD CONTRIBUTING CHARACTERS OF POINTED GOURD (*Trichosanthes dioica* Roxb.)

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ABSTRACT

Aim of this investigation was to determine the effect of fertilizer and irrigation on the yield and yield contributing characters of pointed gourd var. "BARI Patal-1". Different treatments showed significant performances, where the observations revealed that the combination of highest levels of fertilizers (application of Urea and MP both @ 35 g/pit) and irrigation (4 times) confirmed the minimum days to first flower initiation and first harvest. The above combination also ensured the best performances of pointed gourd in respect of nodes per plant, vine length, fruit length and breadth, individual fruit weight, number of fruits per plant, number of seeds per fruit, weight of fruits as well as fruit yield. Always control treatment showed the worst performance. Finally the findings concluded that the yield of pointed gourd increases in an increased rate of fertilizer and irrigation upto a certain level.
Key words: Fertilizer, irrigation, yield, pointed gourd.

Introduction

Pointed gourd (*Trichosanthes dioica* Roxb.) is commonly known as patol and is widely cultivated as summer vegetables in Bangladesh, Assam, West Bangal, Bihar, Orissa and Uttar Pradesh of India. In Bangladesh it is vastly cultivated in the districts of Rajshahi, Pabna, Bogra, Kustia and Jessore, (Rashid, 1993). The pointed gourd is produced in about 24,364 acres of land of Bangladesh with a total production of 85374 M tons having the average yield of 1.4 t/ha (BBS, 2018-19). It is a very important and nutritious due to containing of 5.4 g protein, 0.5 g mineral, 153 mg carotene and 29 mg vitamin-C per 100 g fresh weight (Gopalan *et al.,* 1982). It is easily digestible, diuretic, and laxative, invigorates the heart and brain and is useful in the disorder of the circulatory system (Malek, 2009). Pointed gourd is a perennial and dioecious vegetable that grows as vine with a pencil thickness stem (Hazra *et al.,* 2011). Traditionally it is multiplied through stem cuttings and root suckers (Pandey and Ram, 2000) but possesses the lower yield due to lack of knowledge about the package of practices particularly planting density and proper nutrient management.

Fertilizer is one of the most important inputs contributing to crop production because it increases productivity and improves yield and quality (Sanap *et al.,* 2010). Fertilizer also helps to attain aesthetic value of crops (Siva *et al.,* 2018). Nitrogen fertilization favors the development of the aerial parts over roots and consequently the promotion of flowering and fruiting of many crops. Pointed gourd has huge vegetative growth which needs high amount of nitrogen (Hazra *et al.,* 2011). Potassium is an important element in plant metabolism, promoting carbohydrate translocation from tops to roots. It plays a major role in the production of fruits. Hence, it is necessary for enhancing the fruit yield and yield attributes. So far, no work has been done on effect of N, P, K levels on the yield and quality parameters of pointed gourd in the High Ganges River Floodplain of Bangladesh. On the other hand, water is a very important element for crop production. Irrigation fulfills the water requirement of plants. Irrigation induce flowering in plants. It had been claimed that water stress kept flower buds dormant (Mes, 1957). If the surface soil dried, a decrease in plant yield may be caused by mineral deficiency while the roots were extracting enough water from the lower soil layers to maintain turgor (Hagan *et al.* 1957). He also added that repeated irrigation was necessary in the dry season for higher yield. Dutta (1979) stated that absorption of water helped the intake

of organic salts from the soil. As a result of water transpiration, plants became cooler as a considerable amount of latent heat was lost in converting water from a liquid into a gaseous state. Water was indispensable for photosynthesis because water and carbon dioxide undergo chemical changes leading to the formation of carbohydrates under the influence of chloroplasts and in the presence of sunlight.

Growth and yield performance of pointed gourd using nitrogen and potassium fertilizer at different doses have been studied considerably in various parts of the world. But combined effect of nitrogen and potassium fertilizer with irrigation is not studied considerably, though it is urgent for ensuring vegetables security in the summer season of Bangladesh. Considering the above facts, the main objective of this investigation was to observe the combined effect of fertilizers and irrigation on the yield contributing characters and yield of pointed gourd.

Materials and Methods

The experiment was conducted at the research field of Department of Crop Science and Technology, University of Rajshahi during the period from March, 2018 to September, 2018 with pointed gourd (*Trichosanthes dioica* Roxb.) var. "BARI Patal-1". The site is 24. 370° N and 88.637° E latitude and 200 cm from the sea level. The experimental area was belonging to the Agro Ecological Zone (AEZ-11) "High Ganges River Floodplain". The experiment was designed with two factors Randomized Complete Block Design (RCBD) with three replicates viz., each of three levels of fertilizers (F_0: no fertilizer, F_1: Urea and MP each of 15 g/pit applied at 20, 60 and 90 days after transplanting (DAT), F_2: Urea and MP each of 35 g/pit applied at 20, 60 and 90 DAT) and Irrigation (I_0: no irrigation, I_1: irrigation 2 times (20 and 40 DAT), I_2: irrigation 4 times (20, 40, 60 and 80 DAT). The unit plot size was 2.5m × 1.2m. Plant to plant and row to row distance was 1m and 1.5 m, respectively. Fertilizers were applied as per recommendation of Rashid (1993). Intercultural operations were done, when it was necessary. Data were recorded for desired parameters from the sample plants at harvest. Ten (10) plants were randomly selected from each unit plot for the collection of data. The findings obtained from the experiment were analyzed statistically following MSTAT-C package program. The mean values recorded against all the treatments were compared by Duncun's Multiple Range Test (DMRT) and also with the help of LSD values following Gomez and Gomez (1984).

Results and Discussion

Vine length: Effect due to fertilizer and irrigation on vine length at first harvest of pointed gourd was found to be significant (Table 1). The maximum vine length (3.50 m) at first harvest was observed with the combination of F_2I_2 (Urea and MP each of 35 g/pit applied at 20, 60 and 90 DAT and irrigation at 20, 40, 60 and 80 DAT) which was statistically similar with the treatment F_2I_1. On the other hand, the minimum vine length (1.65 m) was observed with the treatment F_0I_0 (control, no fertilizer and no irrigation) which was statistically different from all other treatment combination at first harvest. That means combination of higher levels of fertilizer and higher frequencies of irrigation showed higher vine length whereas combination of lower levels and frequencies of those showed lower number of vine length at first harvest of pointed gourd. Umekwe *et al.* (2015) were reported increased plant height in cucumber with increased fertilizer levels.

No. of nodes per plant: The present investigation showed that various levels of fertilizer and irrigation had highly significant effect on no. of nodes per plant at first harvest (Table 1). The maximum no. of nodes per plant (48.33) at first harvest was observed in treatment F_2I_2 which was statistically similar with F_2I_1 and F_2I_0. On the other hand, the treatment combination F_0I_0 (control) resulted in the minimum no. of nodes per plant (26.98) at first harvest which was statistically different from all other treatments. These results were in conformity with the findings of Karataev and Salnikova (1982) in parthenocarpic cucumber and Ekmw and Nwokwu (2012) in bhendi.

Days required to first flower initiation: Effect due to fertilizer and irrigation on number of days to first flower initiation was found being significant (Table 1). The treatment combination F_2I_2 (Urea and MP each of 35 g/pit applied at 20, 60 and 90 DAT and irrigation at 20, 40, 60 and 80 DAT) took minimum number of days required (90.33 days) to first flower initiation which was statistically identical with F_2I_1. On the other hand, the maximum number of days required (101.67) to first flower initiation was observed in treatment F_0I_0 (control, no fertilizer and no irrigation) which was statistically similar with all other treatments except F_2I_2 and F_2I_1. Less number of days taken to first flower initiation with higher levels of fertilizer and frequencies of irrigation might be due to early vegetative growth and hastening the initiation of reproduction phase. These results were in conformity with the findings of Jilani *et al.* (2009).

Days required to first harvest: The use of fertilizer and irrigation in the production of pointed gourd has proved greatly increasing in days required to first harvest compared to not using fertilizer and irrigation at all. The treatment combination F_2I_2 took minimum number of days required (104.33) to first harvest of pointed gourd which was statistically similar with all other treatments except F_0I_1 and F_0I_0 (table 1). On the other hand, the treatment combination F_0I_0 took the maximum number of days (115.67) required to first harvest of pointed gourd which was statistically identical with all other treatment except F_2I_1 and F_2I_2. That means, less number of days required to first harvest was observed with higher levels of fertilizer and frequencies of irrigation might be due to early vegetative growth and hastening the initiation of reproduction phase. These results were in conformity with the findings of, Kanwar *et al.* (2013) in sweet pepper, Kumar *et al.* (2012) in bottle gourd and Wazed *et al.* (2013) in snake gourd.

Table 1. Effect of fertilizer and irrigation on vegetative growth of pointed gourd

Treatments	Vine length (meter) at first harvest	No. of nodes/plant at first harvest	Days required to first flower initiation	Days required to first harvest
F_0I_0	1.65 f	26.98 h	101.67 a	115.67 a
F_0I_1	2.03 e	30.98 g	99.30 ab	113.30 ab
F_0I_2	2.30 d	32.98 ef	97.90 ab	111.90 a-c
F_1I_0	2.75 c	36.22 de	96.17 ab	110.17 a-c
F_1I_1	2.94 bc	39.55 cd	95.00 ab	109.00 a-c
F_1I_2	3.05 b	42.22 bc	93.93 ab	107.93 a-c
F_2I_0	3.17 b	44.50 ab	94.33 ab	108.33 a-c
F_2I_1	3.40 a	46.17 ab	92.47 bc	106.47 bc
F_2I_2	3.50 a	48.33 a	90.33c	104.33 c
CV (%)	5.00	5.98	4.68	4.08
LSD (5%)	1.23	3.96	7.68	6.55

Means followed by the same letter(s) do not statistically differ at 5% level tested by DMRT.

Fruit Length: Combined effect due to fertilizer and irrigation on fruit length of pointed gourd was found to be significant (Table 2). The maximum fruit length (11.40 cm) was obtained from F_2I_2 (Urea and MP each of 35 g/pit applied at 20, 60 and 90 DAT and irrigation at 20, 40, 60 and 80 DAT) which was closely followed by F_2I_1, F_2I_0 and F_1I_2. On the other side, the treatment combination F_0I_0 (control, no fertilizer and no irrigation) result the minimum fruit length (7.20 cm) which is statistically similar with the treatment F_0I_1. Tripathy *et al.* (1993) found that NPK each at 30 Kg ha^{-1} gave higher yield and longest fruits while plant height and leaf area were greater with N, P_2O_5, and K_2O each at 60kg/ha level in spine gourd which supported the present findings.

Fruit breadth: Like fruit length due to combined effect of fertilizer and irrigation, fruit breadth was also found to be significant (Table 2). The maximum fruit breadth (3.77 cm) was observed with F_2I_2 which was statistically similar with the treatment combination of F_2I_1 and F_2I_0 whereas the minimum fruit breadth was

observed with the treatment combination of F_0I_0 (2.23 cm) which was statistically similar with F_0I_1. That means combination of higher levels of fertilizer and higher frequencies of irrigation showed higher fruit breadth whereas combination of lower levels and frequencies of irrigation those showed lower fruit breadth of pointed gourd. This might be due to slow and continuous nutrient and water supply. These results were in conformity with the findings of Choudhari and More (2002) in cucumber.

Table 2. Effect of fertilizer and irrigation on the yield as well as yield attributes of pointed gourd

Treatments	Fruit length (cm)	Fruit breadth (cm)	No. of fruits per plant	No. of seeds per fruit	Individual fruit weight (g)	Fruit yield (t/ha)
F_0I_0	7.20 e	2.23 f	49.64 c	20.45 g	35.03 c	11.80 e
F_0I_1	7.83 de	2.53 ef	57.28 c	20.98 fg	36.61 c	14.00 de
F_0I_2	8.23 cd	2.67 de	59.75 c	21.52 e-g	37.37 c	14.89 d
F_1I_0	8.93 c	3.03 cd	103.48 b	23.17 d-f	44.57 b	19.40 c
F_1I_1	9.87 b	3.13 c	107.31 b	23.73 c-e	45.23 b	21.27 c
F_1I_2	10.87 a	3.23 bc	109.04 b	24.30 b-d	46.70 b	22.08 c
F_2I_0	10.67 ab	3.55 ab	123.52 a	26.10 a-c	53.30 a	26.69 b
F_2I_1	11.00 a	3.63 ab	125.66 a	26.67 ab	54.63 a	29.60 a
F_2I_2	11.40 a	3.77 a	129.11 a	27.07 a	55.03 a	30.47 a
CV (%)	5.87	5.42	6.59	5.77	5.76	5.71
LSD (5%)	0.92	0.39	5.85	2.35	6.14	2.83

Means followed by the same letter(s) do not statistically differ at 5% level tested by DMRT.

No. of fruits per plant: Table 2 shows that the maximum no. of fruits per plant (129.11) was produced by treatment F_2I_2 which was closely followed by F_2I_1 and F_2I_0. On the other hand, the treatment combination F_0I_0 resulted in the minimum no. of fruits per plant (49.64) which was statistically identical with the treatment F_0I_1 and F_0I_2. These results were in conformity with the findings of Rahul *et al. (*2010). Ravikumar *et al.* (2005) also recorded highest number of fruits per plant of cucumber with the application of 120:80:50 kg NPK/ha.

No. of seeds per fruit: Effect due to fertilizer and irrigation on no. of seeds per fruit was found to be significant (Table 2). The maximum no. of seeds per fruit (27.07) was observed with the combination of F_2I_2 (27.07) which were statistically similar with the treatment F_2I_1 and F_2I_0. On the other hand, the minimum no. of seeds per fruit (20.45) was found in treatment F_0I_0 which was statistically identical with the treatment F_0I_1 and F_0I_2. That means combination of higher levels of fertilizer and higher frequencies of irrigation showed higher number of seeds per fruit whereas combination of lower levels and frequencies of those showed lower number of seeds per fruit of pointed gourd. These results were in conformity with the findings of Kumar *et al.* (2012).

Individual fruit weight: The present investigation showed that various levels of fertilizer and irrigation had highly significant effect on individual fruit weight of pointed gourd (Table 2). The maximum individual fruit weight (55.03g) was obtained in treatment F_2I_2 which was statistically similar with F_2I_1 and F_2I_0. On the other hand, the minimum individual fruit weight (35.03 g) was observed in treatment combination of F_0I_0 which is statistically similar with the treatment combination of F_0I_1 and F_0I_2. The increase in the weight of fruits with the application of nutrients might be due to high and continuous nutrients availability from combined sources of plants leading to good growth with an increase in the photosynthetic area and translocation of photosynthates in plants which subsequently accelerated the formation of more number of large sized fruits resulting in the increased fruit weight. The research findings of Jilani *et al.* (2009) indicated that NPK fertilizer (100-50-50) application in cucumber showed maximum fruit weight (136.03 g). Rahul *et al.* (2010) recorded that the combinations of N P K (200 kg N ha^{-1} +

50 kg P_2O_5 ha^{-1} + 100 kg K_2O ha^{-1}) recorded the maximum weight of fruit (230.45g) in cucumber. Their findings are supported the present results.

Fruit yield: Combined effect due to fertilizer and irrigation on fruit yield (ton/ha) of pointed gourd was found to be significant (Table 2). The maximum fruit yield (30.47 ton/ha) of pointed gourd was observed with treatment F_2I_2 (Urea and MP each of 35 g/pit applied at 20, 60 and 90 DAT and irrigation at 20, 40, 60 and 80 DAT) which is statistically identical with the treatment F_2I_1. However, the treatment combination F_0I_0 (control, no fertilizer and no irrigation) resulted in the minimum fruit yield (11.80 ton/ha) of pointed gourd which was statistically similar with the treatment F_0I_1. That means the combination of higher levels of fertilizer and higher frequencies of irrigation ensured the higher fruit yield of pointed gourd whereas combination of lower levels and frequencies of those showed lower fruit yield. Naeem *et al.* (2002) reported that different doses of NPK behaved significantly different for total yield in chili. These results were in conformity with the findings of Anjanappa *et al.* (2012) in cucumber. The production of the higherindividual fruit weight was possibly due to application of irrigation just after fertilization which helped solubilizing the fertilizer and reaching to the root zone rapidly. Water also increase meristematic and physiological activities in the plants due to the supply of plant nutrients and important soil properties, thereby resulting in the synthesis of more photo-assimilates, which are used in producing fruit yields.

Conclusion

It may be explored that application of Urea and MP both at 35g/pit and 4 times application of irrigation can be used successfully for commercial pointed gourd production. However, further investigation by field trial should be carried out in other region of the country before final recommendation.

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