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Effect of irrigation and pollination on the yield of pumpkin

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Abstract: Abstract: An experiment was conducted at the Horticulture Farm, Bangladesh Agricultural University, Mymensingh during the period from November, 2000 to March, 2001 to investigate the possibility of increasing the yield of pumpkin by supplementing different levels of irrigation and methods of pollination. The highest yield (26.84 t/ha) was achieved from 15 days interval irrigation compared to the control treatment (17.92 t/ha). The natural-plus-artificial pollination (female flowers were covered by polythene bags before and after pollination) produced the highest yield (25.05 t/ha), while natural pollination gave the lowest yield (19.82 t/ha). The combined treatment natural-plus-artificial pollination and irrigation at 15 days interval resulted the highest production (31.69 t/ha) which was about 50 % more yield than that of natural pollination and control irrigation.
Key words: Irrigation, pollination, pumpkin.

Introduction

Pumpkin (*Cucurbita moschata* Duch ex Poir) is one of the most popular and commercially important vegetable grown round the year in Bangladesh from ancient times. It is a water consuming crop; irrigation prolongs the productive life of the crop and enhances fruit yields and the highest percentage of plant survival (Asoegwu, 1988). The proper timing of irrigation plays an important role towards increased production. Pumpkin is a monoecious crop. It is frequently observed that, the fruit set in pumpkin is poor due to many known and unknown factors. One of the limiting factors for setting fruits is the unavailability of sufficient pollinating insects (Chowdhury *et al*., 1982). The monoecious nature of the plant necessitates cross-pollination by insects, like honey bee and other agencies to ensure fruit setting. The problem of pollination may become acute if the number of pollinators is insufficient due to their thin population, which is related to the natural phenomenon such as temperature, rain, wind, or use of insecticides. To overcome this problem, practice of artificial pollination is the option in increasing fruit set and yield of gourd (Sharma *et al*., 1982). Therefore, the experiment was undertaken to study the effect of different levels of irrigation and methods of pollination on the yield of pumpkin.

Materials and Methods

The experiment was conducted at the Horticulture Farm, Bangladesh Agricultural University, Mymensingh during the period from November, 2000 to March, 2001. The total plot area was 15m x 41m. The selected land was thoroughly prepared by ploughing and cross ploughing. The plots were raised by 10 cm from the ground level. Four pits of 60cm x 60cm x 50 cm size were prepared in each plot at a spacing of 2m plant to plant. Fertilizers were applied @ Cowdung 15 t/ha, Urea 150 kg/ha, TSP 125 kg/ha and MoP 100 kg/ha. Twenty five per cent of cowdung were mixed with soil as basal dose during final land preparation. The remaining cowdung, entire quantity of TSP and half of the quantity of urea and MoP were applied in pits at the time of its preparation. The rest half of urea and MoP were applied by ring placement method in two installments at 30 and 50 days after emergence of seeds. Seeds of pumpkin cv. Baromasi were sown. Four to five seeds were dibbled 2-3 cm deep in soils of each pit on 14th November, 2000. When plants were 8-10 cm long, they were thinned out to 2 healthy plants per pit. Weeding was done as and when necessary. Rice straw was used under each fruit to protect them from coming in contact with soil to prevent soil pests and diseases attack. Irrigation was given upto saturated condition of soil at 15 days after seed emergence as per treatments. It was practiced by watering can until full saturation of the soil occurred. There were three irrigation levels (0, 15, 30 days interval) and 3 pollination methods (natural, artificial and natural-plus-artificial) with three replications. The whole experimental plot was divided into 3 blocks. Each block was divided into 9 plots where 9 treatment combinations were randomly distributed. The size of each unit plot was 16m^2 (4m x4m) where 4 pits were accommodated maintaining a distance of 2m from one pit to another. Each block had thus 36 pits and the whole experiment had in total 108 pits.

In natural-plus-artificial pollination treatment, pollination was done by hand whether flowers were naturally pollinated or not. Artificial pollination was practiced by picking up a fully open male flower; detaching carefully the petals and shaking stamen over the female flowers were left exposed. In case of artificial pollination treatment, the female flowers were bagged with polythene before anthesis to avoid possibilities of natural pollination. As soon as the flower in the bag was seen to be fully opened, removing polythene bag as per the method followed in case of natural-plus-artificial pollination did artificial pollination. Immediately after pollination the flower was bagged again and kept in this condition until the petals were closed down. The pollination was done in the morning between 5.00 to 7.00 am. In all the case, the male flowers used for pollination were collected from the same plant. Red pumpkin beetles were controlled mechanically by hand picking in the early stages and later on chemically by spraying Diazinon 60 EC @ 1.7 L/ha at 15 days interval. Quick fume tablets were used in rat holes for killing rat. The crop was started harvesting after 120 days of plant emergence when the fruit peduncle dried on maturity. It was done on 20 March, 2001 and was continued until all the leaves and the plants dried out. The collected data on various parameters were analyzed statistically by MSTAT computer programme. The difference between the treatment means was judged by least significant difference (LSD) test.

Results and Discussion

The results of the experiment are presented Tables 1-3. It is evident from the results that the pumpkin was significantly and progressively influenced by the application of different levels of irrigation and methods of pollination. Effect of different levels of irrigation had significantly influenced on the number of male and female flowers. Fifteen days interval irrigation gave maximum number of male (37.51) and female (6.32) flowers, while the minimum number of male (28.29) and female (3.99) flowers was recorded from control plants (Table 1). It appeared from the results that, frequent irrigation produced maximum number of flowers per plant, and this might have happened due to the influence of increased cell expansion and hormonal activity responsible for flowering encouraged by irrigation water. Maximum vegetative growth including production of large number of leaves in 15 days interval irrigated plants led to formation of heaviest fruit. Desai and Patil (1984) reported that heaviest fruit was obtained by frequent irrigation.

Table 1. Effect of different levels of irrigation on the yield of pumpkin

Levels of irrigation	No. of flowers/plant		% of fruit setting	Ave. wt. of fruit/plant (kg)	No. of fruits/plant	Yield/plant (kg)	Yield/ha (ton)
	Male	Female					
I_0	28.29	3.99	45.99	2.69	2.66	5.25	17.92
I_1	37.51	6.32	65.88	4.60	4.09	8.02	26.84
I_2	35.45	5.22	60.82	3.82	3.86	3.85	22.22
LSD 5%	5.789	1.227	2.992	.0349	0.342	0.460	1.539
LSD 1%	-	-	4.123	0.481	0.471	0.634	2.327
Level of significance	*	*	**	**	**	**	**

I_0: Non irrigated; I_1: Irrigation at 15 days interval, I_2: Irrigation at 30 days interval * Significant at 5% level ** Significant at 1% level,

Table 2. Effect of different methods of pollination on the yield of pumpkin

Methods of pollination	% of fruit setting	Ave. wt. of fruits/ plant (kg)	No. of fruits /plant	Yield/plant (kg)	Yield/ha (ton)
P_0	52.79	3.76	3.24	5.92	19.82
P_1	61.75	3.64	3.92	7.48	25.05
P_2	58.15	3.71	3.44	6.60	22.09
LSD 5%	2.99	-	0.342	0.460	1.539
LSD 1%	4.14	-	0.472	0.634	2.412
Level of significance	**	NS	**	**	**

P_0: Natural pollination; P_1: Natural-plus-artificial pollination, P_2: Artificial pollination ** Significant at 1% level, NS: Not Significant

Effect of pollination of the natural-plus-artificial led to highest percentage of success in fruit setting (61.75 %) while the minimum success (52.79 %) was observed in the natural pollination differing significantly from other two treatments (Table 2). The lower rate of fruit setting in natural pollination might be due to the fact that pollinators failed to visit pistillate flowers due to crowding of leaves around them. Moreover, lack of sufficient pollinating insects might be another reason for lower fruit setting. In natural-plus-artificial treatment, the percentage of success in fruit setting though was not significantly different, but still was comparatively higher than artificial pollination. The reason of such trend of higher success is obscure. However, the possible reason was that bagging of flower might create environments adverse to fruit setting i.e. high temperature and saturated moisture inside the bag probably diluted the fluid of stigma reducing to some extend the possibilities of successful pollination. Pollen germination may even be affected at this condition. Hayase (1961) and Iapichino (1988) reported that viability of pollen decreases with the increasing temperature accompanied by saturated humidity. The result obtained by Bose and Som (1986) and Sharma *et al*., (1982) also corroborate with the present findings. The highest

percentage of fruit setting (70.81 %) was obtained from irrigation at 15 days interval with natural-plus-artificial pollination while the lowest (41.94 %) was recorded from no irrigation and natural pollination (Table 3).

Table 3. Combined effect of irrigation and methods of pollination on the yield of pumpkin

Levels of irrigation and methods of pollination	% of fruit setting	Ave. wt. of fruits/plant (kg)	No. of fruits/plant	Yield/plant (kg)	Yield/ha (ton)
I_0P_0	41.94	2.77	2.37	4.86	16.27
I_0P_1	49.26	2.60	3.13	5.75	19.26
I_0P_2	46.76	2.70	2.50	5.44	18.21
I_0P_0	60.16	4.63	3.73	6.85	22.92
I_1P_1	70.81	4.57	4.50	9.47	31.69
I_2P_2	66.68	4.40	4.05	7.73	25.89
I_0P_0	56.26	3.87	3.62	6.06	20.28
I_1P_1	65.18	3.77	4.15	7.23	24.19
I_2P_2	61.02	3.82	3.77	6.63	22.19
LSD 5%	5.183	0.605	0.592	0.797	2.667
LSD 1%	7.142	0.833	0.816	1.098	3.854
Level of significance	**	**	**	**	**

** Significant at 1% level, I_0: Non irrigated; I_1: Irrigation at 15 days interval, I_2: Irrigation at 30 days interval, P_0: Natural pollination; P_1: Natural-plus-artificial pollination, P_2: Artificial pollination

Combined effects of significant variation in number of fruits per plant and per hectare were observed due to irrigation and pollination. Fifteen days interval irrigation produced the maximum number of fruits per plant (3.86) while the minimum (2.66) was produced by non irrigated plant (Table 1). Natural-plus-artificial pollination produced the maximum number of fruits per plant (3.92) while the minimum numbers (3.24) was produced by natural pollination (Table 2). This trend of result partially agrees with the findings of Chartzoulakis and Michelakis (1990). Ensured continuous water supply caused by narrow interval of irrigation might create condition for accomplishing all physiological process in right manner leading to production of increased dry matter and flower including hormones in plants for initiation and development of more fruits in this treatment. The result was in support of Chowdhury *et al*. (1982) who obtained the highest percentage of fruit setting from natural-plus-artificial pollination. The mark variation among the methods of pollination in relation to number of fruits per plant was possibly due to successful completion of pollination and fertilization process.

Maximum yield per plant (8.02 kg) and per hectare (26.84 ton) was produced by 15 days interval irrigation, while the minimum yields (5.35 kg and 17.92 ton) were from control plants (Table 1). Pollination methods also significantly influenced yield. Maximum yield per plant and per hectare (7.48 kg and 25.05 ton) were produced by natural-plus-artificial pollination whereas the minimum (5.92 kg and 19.82 ton) were obtained from natural pollinated plants (Table 2). Their combined effect was found to be significant for both the yield per plant as well as per hectare. Fifteen days interval irrigation when applied with natural-plus-artificial pollination produced the maximum yield per plant (9.47 kg) and per hectare (31.69 ton). On the other hand no irrigation and natural pollination caused the lowest yield per plant (4.86 kg) and per hectare (16.27 ton), respectively (Table 3). The interaction effect in respect of yield per plant and per hectare was also found to be significant. Limbulkar *et al.* (1988) recorded more yield with frequent of irrigation. Perhaps frequent irrigated plant resulted more vegetative growth in terms of leaf production resulting in the highest yield per plant.

The natural-plus-artificial pollination ensured more fruit setting through successful pollination and afterwards fertilization. Sharma *et al.* (1982) found that fruit set and yields of pumpkins were higher with hand pollination which is also in consonance with the present findings.

Chowdhury *et al*. (1982) also reported significantly higher yield from the treatment of natural-cum-hand pollination compared to natural or artificial pollination. Following this production technique, farmers would gain a high profitable by selling increased pumpkin at high price particularly during rainy season of vegetables lean period. However, to make specific recommendation further investigation with other varieties to different planting dates, more irrigation levels trial need to be conducted.

References

Asoegwu, S.N. 1988. Effects of irrigation on the leaf and pod production of fluted pumpkin (*Telfairia occidentalis* Hook) in southern Nigeria. Scientia Hort., 34 (3&4): 161-168.

Bose, T.K. and Som, M.G. 1986. Vegetable Crops in India. B. Mitra, Naya Prokash, 206, Bidhainsarani, Calcutta, India. pp. 107-114.

Chartzoulakis, K. and Michelakis, N. 1990. Effects of different irrigation systems on root growth and yield of green house cucumber. Acta Hort., 278: 237-243.

Chowdhury, A.R., Bhuiyan, S.A. and Quasem, A. 1982. Effect of artificial pollination on the yield of pumpkin. Bangladesh Hort., 42(3&4): 271-276.

Desai, J.B. and Patil, V.K. 1984. Effect of sowing dates and irrigation on growth, yield and quality of watermelon. Indian J. Hort., 42(3&4): 271-276.

Hayase, H. 1961. Effect of temperature and humidity on the germination power of cucumber pollen after anther dehiscence. J. Jap. Soc. Hort. Sci., 30: 24-28.

Iapichino, G.F. 1988. High temperature stress affects pollen viability in bottle gourd. J. Amer. Soc. Hort. Sci., 112(2): 372-374.

Limbulkar, C.S., More, G.R. and Suryawanshi, S.N. 1988. Yield response of cucumber to micro-irrigation. J. Maharashtra Agril. Univ., 23(1): 77-79.

Sharma, C.P. Jyotishi, R.P. and Agrawal, G.P. 1982. Effect of artificial hand pollination on fruit set and yield of pumpkin. JNKVV Res. J., 16(3): 289-292.