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GROWTH AND YIELD OF *KHARIF* ONION (*Allium cepa* L.) AS INFLUENCED BY DATES OF PLANTING AND CULTIVARS IN RED AND LATERITE ZONE OF WEST BENGAL

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ABSTRACT : An experiment was conducted at Horticulture Farm of Institute of Agriculture, Visva-Bharati, Sriniketan (West Bengal) to find out the optimum planting dates and cultivars of onion suitable for *kharif* season in this region. The treatments consisted of four dates of planting (15th and 30th August and 15th and 30th September) and five cultivars (Agrifound Dark Red, Arka Kalyan, Arka Niketan, Indam Marshal and Red Stone). The experiment was laid out in factorial randomized block design with three replications. There was a significant increase in growth of plants and size of bulbs when planting delayed from August to September. The overall performance of *kharif* onion in red and laterite belt of West Bengal was highly satisfactory with average bulb yield 171.1q/ha. Data revealed that the cultivar Agrifound Dark Red when planted on 30th September gave superior result in almost all yield parameters and yield.

Keywords: *Kharif onion, planting date, cultivar, growth and yield.*

Onion (*Allium cepa* L.) is one of the most important vegetable crops among the various bulbs producing vegetables. It is generally grown as winter crop in India. Due to shortage of onion often from October onwards the market price hiked to a great extent. *Kharif* onion played a crucial role to meet this demand-supply gap and thereby reducing the price-rise of onion. Growing of onion during *kharif* season is somewhat a new strategy to be adopted in eastern India. Suitable agro-techniques are needed to get a remunerative return from large scale *kharif* season cultivation in West Bengal. In West Bengal, generally onion is cultivated during *rabi* season and the bulbs are made available from April onwards. The state has to depend on the other states which produce *kharif* and late *kharif* onion for supply of bulb during lean period (October to March). Such dependencies are sometimes resulted in abnormal increase in the prices. The situation may be improved to some extent, if the possibilities and potentialities of *kharif* onion cultivation are exploited. The growth and yield of cultivated crop plants are mainly influenced by two factors viz., genetical and cultural or management. Genetic makeup and environment are the factors which depict the performance of a cultivar by influencing all important traits (Brewster, 1). Planting time is one of important factor that greatly influence the growth and yield of onion (Mondal and Brewster, 12). Consequently, varieties should be screened for the area where they are to be grown. Thus, it is imperative to assess the performance of a cultivar for a specific location, especially for *kharif* onion which is a new venture to the growers of this locality. With this idea the present investigation was formulated to find out the optimum planting dates and cultivars of onion suitable for *kharif* season in red and laterite zone of West Bengal.

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MATERIALS AND METHODS

The experiment was conducted at the Horticulture Farm of Institute of Agriculture, Visva-Bharati, Sriniketan (West Bengal) during 2013-14. The treatment consisted of four different planting dates *viz.*, 15th August (D_1), 30th August (D_2), 15th September (D_3) and 30th September (D_4) and five cultivars *i.e.* Agrifound Dark Red (V_1), Arka Kalyan (V_2), Arka Niketan (V_3), Indam Marshal (V_4) and Red Stone (V_5). The planting was done 2m x 1.5m plots in 15cm x 10cm spacing. The experiment was laid in factorial randomized block design with three replications. Normal agronomic package of practices were adopted to raise the crop successfully. Data recorded at harvest on growth parameter (plant height, number of leaves/plant, leaf length, leaf diameter, neck length and neck diameter) and yield parameter (plant fresh weight, leaf fresh weight, average bulb weight, polar diameter and equatorial diameter and bulb yield).

RESULTS AND DISCUSSION

Plant height

Planting dates showed significant difference in plant height (Table 1). Late transplanted plants were

Table 1: Effect of date of planting and cultivar on growth parameters of onion.

	Plant height (cm)	Number of leaves /plant	Leaf length (cm)	Leaf diameter (mm)	Neck length (cm)	Neck diameter (mm)
Dates of Planting						
D_1	65.4[a]	8.9[b]	55.0[c]	8.6[c]	5.9[b]	11.8[c]
D_2	62.4[b]	8.8[b]	49.4[d]	10.2[b]	6.0[b]	12.3[c]
D_3	64.4[b]	9.3[a]	60.7[b]	11.0[a]	6.7[a]	15.9[b]
D_4	69.8[a]	9.6[a]	66.4[a]	11.4[a]	6.8[a]	17.9[a]
C.D (P=0.05)	2.7	0.4	2.5	0.9	0.3	0.8
Cultivars						
V_1	68.5[b]	9.5[b]	63.5[a]	11.3[b]	6.6[a]	16.8[a]
V_2	61.6[c]	8.5[c]	53.0[b]	9.1[c]	6.1[b]	13.1[b]
V_3	59.6[c]	8.6[c]	52.4[c]	9.3[c]	6.2[b]	13.5[b]
V_4	77.8 [a]	10.5[a]	65.0[a]	12.4[a]	6.7[a]	15.9[a]
V_5	60.[7c]	8.6[c]	55.5[b]	9.4[c]	6.2[c]	13.3[b]
C.D (P=0.05)	3.0	0.4	2.5	1.0	0.4	1.0
Dates of Planting × Cultivar						
D_1V_1	67.9	9.3	57.6[c]	9.3	6.6	13.7[d]
D_1V_2	61.5	8.3	52.5[d]	8.5	5.1	11.3[e]
D_1V_3	61.7	8.3	52.4[d]	7.5	5.6	10.6[e]
D_1V_4	76.2	9.7	59.0[c]	9.4	6.3	13.1[d]
D_1V_5	59.9	8.7	53.3[d]	8.3	6.0	10.5[e]
D_2V_1	64.9	9.3	53.3[d]	11.2	6.4	14.5[c]
D_2V_2	59.0	8.0	47.7[e]	8.3	5.9	11.1[e]
D_2V_3	55.8	8.3	47.1[e]	9.0	5.8	11.8[e]
D_2V_4	74.5	9.9	51.0[d]	13.8	6.2	13.4[d]
D_2V_5	57.9	8.0	47.8[d]	8.8	5.9	10.9[e]
D_3V_1	68.3	9.7	67.3[b]	11.8	6.9	18.1[b]
D_3V_2	62.4	8.7	53.7[c]	9.9	6.6	13.9[d]
D_3V_3	58.2	8.7	53.5[c]	10.6	6.6	14.5[c]
D_3V_4	76.2	10.7	74.4[a]	12.9	7.4	17.9[b]
D_3V_5	59.2	8.7	54.6[c]	9.6	6.0	15.0[c]
D_4V_1	73.0	9.7	75.7[a]	12.8	6.7	20.8a
D_4V_2	63.3	9.0	57.9[c]	9.8	6.7	15.9[c]
D_4V_3	62.8	9.0	56.4[c]	10.1	7.0	17.0[b]
D_4V_4	84.4	11.3	75.4[a]	13.2	6.9	19.1[a]
D_4V_5	65.7	9.0	66.4[b]	10.8	6.8	16.8[b]
GM	65.6	9.1	57.9	10.3	6.3	14.5
C.D (P=0.05)	NS	NS	5.5	NS	NS	1.9
CV (%)	5.5	5.4	5.8	11.5	6.7	7.8

taller than early transplanted plants. Plants get more congenial weather in later date of planting that was helpful for better growth and development of onion plant. Ishwori *et al*. (5) and Khodadadi (7) reported that planting date had significant effect on plant height. Onion cultivars were significantly influenced the plant height. Indam Marshal produced maximum plant height throughout the growing period followed by Agrifound Dark Red. Jain and Sarkar (6) also reported different plant height for different cultivars of onion. Interaction effect was noted non-significant for plant height.

Number of leaves/plant

Maximum number of leaves /plant was noted in 30th and 15th September planting. Two were found statistically at par. Das (3) also noted variation in leaf number in different dates of planting. Among the cultivars, Indam Marshal produced maximum number of leaves /plant (10.5), followed by the Agrifound Dark Red (9.5). Chandrika and Reddy (2) noted the varietal different of onion in leaf number per plant. Interaction effect was noted non-significant for leaf number per plant. Number of leaves per plant did not affected by combination of various planting materials and different date of planting as also reported by Nayee *et al*. (13). However, Mohanty (11) found significant relationship between planting dates and cultivars.

Leaf length and diameter

Leaf length and diameter were significantly increased as planting dates progressed from August to September. Maximum leaf length and diameter were noted on 30th September planting, followed by planting on 15th September. Unfavourable weather condition due to heavy raining in earlier dates of planting may hamper proper growth of the plants that affected leaf length and diameter. This finding is in line with Khurana *et al.* (8). Cultivars also differed significantly for leaf length and diameter. Among five cultivars, maximum leaf length and diameter was noticed in cultivar Indam Marshal, followed by Agrifound Dark Red. The interaction effect was also significant for leaf length. Indam Marshal planted on 15th or 30th September and Agrifound Dark Red planted on 30th September resulted maximum leaf length. However, no significant interaction was noticed for leaf diameter.

Neck length and diameter

Neck length and diameter are important traits having relation with bulb storage ability. Neck length and diameter varied significantly among the different planting dates. Maximum neck length and diameter was recorded on 30th September planting, followed by planting on 15th September. Increase in neck length and diameter owing to the overall increase in bulb size. Mahadeen (9) and Nayee *et al*. (13) also reported similar trends. Among fives cultivars, the maximum neck length and diameter was noted in Agrifound Dark Red and Indam Marshal. The interaction effect of date of planting and cultivar was non-significant for neck length, but significant for neck diameter (Table 1). The highest neck diameter was obtained in cultivar Agrifound Dark Red (20.8mm) and Indam Marshal (19.1mm) on 30th September planting.

Plant and leaf fresh weight

Plant and leaf fresh weight (Table 2) revealed a significant difference, as a result of different planting dates, cultivars and their interactions, except for planting date on leaf fresh weight. Maximum plant fresh weight of 103.4g was obtained on 30th September planting. August plantings were significantly low in plant weight than September planting. Among the cultivars, Agrifound Dark Red produced the highest plant fresh weight (109.6g), followed by Indam Marshal (102.9g). With respect of interaction effect of planting date and cultivar, the highest plant fresh weight of 122.8g was obtained in Agrifound Dark Red, when planted on 30th September. On the other hand, cultivar Red Stone (32.1g), Indam Marshal (31.6g) and Agrifound Dark Red (30.4g) produced highest fresh leaves weight. Interaction effects on leaf fresh weight showed a wide variation. Maximum leaf fresh weight were noted in Agrifound Dark Red and Indam Marshal on 30th August planting, Red Stone on 15th September planting and Arka Kalyan and Red Stone on 30th September planting.

Average bulb weight

Bulb weight is an important yield attributing character. It has been significantly influenced by different date of planting, various cultivars and their interactions. Planting dates influenced bulb weight in a significant manner. The maximum bulb weight (82.6g) was obtained on 30th September planting, followed by planting on 15th September (68.4g). Influence of planting dates on bulb weight was also reported by Singh and Singh (15) and Mahadeen (9). Among the cultivars, Agrifound Dark Red produced the highest bulb weight (80.9g), followed by Indam Marshal (71.8g). Lowest bulb weight was found on Arka Niketan (52.2g). A difference among cultivars for this trait was also noted by Mahanthesh *et al*. (10). With respect of interaction effect of planting dates and cultivars, the highest bulb weight (104.2g) was obtained in Agrifound Dark Red when planted on 30th September, which was noted significantly superior to others.

Polar and equatorial diameter

Polar diameter and equatorial diameter of bulb is an important character which determines the shape and size of bulb. Polar and equatorial diameters of bulb were significantly influenced by planting dates and cultivars. The maximum polar and equatorial diameter was observed in 30th September planting, followed by planting on 15th September. Increased trend of bulb diameters were noted as planting delayed from August to September. Sharma *et al*. (14) also reported on

Table 2 : Effect of date planting and cultivar on yield parameters.

	Plant fresh weight (g)	Leaf fresh weight of onion (g)	Average bulb weight (g)	Polar diameter (mm)	Equatorial diameter (mm)	Bulb yield (q/ha)
Dates of Planting						
D_1	82.2[c]	29.2	55.2[c]	42.4[b]	44.4[c]	132.1[d]
D_2	83.1[c]	32.0	50.8[d]	43.0[b]	44.2[c]	154.2[c]
D_3	97.8[b]	29.3	68.4[b]	45.1[a]	48.2[b]	171.6[b]
D_4	103.4[a]	29.1	82.6[a]	46.5[a]	52.7[a]	226.[5a]
C.D (P=0.05)	3.4	NS	3.6	1.7	1.4	13.6
Cultivars						
V_1	109.6[a]	30.4[a]	80.9[a]	45.7[a]	51.0[a]	235.2[a]
V_2	85.9[c]	28.4[b]	58.5[c]	43.9[b]	45.4[b]	139.3[b]
V_3	78.2[d]	27.1[b]	52.2[d]	43.1[b]	43.6[c]	123.7[c]
V_4	102.9[b]	31.6[a]	71.8[b]	46.2[a]	50.0[a]	231.4[a]
V_5	81.4[d]	32.1[a]	58.0[c]	42.4b	46.8[b]	126.0[b]
C.D (P=0.05)	3.8	3.5	4.1	1.9	1.5	15.2
Dates of Planting x Cultivars						
D_1V_1	93.4[d]	31.2[b]	66.2[c]	42.7	50.5[b]	185.5
D_1V_2	80.1[e]	29.5[b]	51.7[e]	44.4	43.9[d]	109.4
D_1V_3	57.0[g]	21.9[c]	38.9[f]	41.9	37.5[f]	91.3
D_1V_4	92.1[d]	35.1[b]	56.3[d]	43.2	46.3[c]	188.0
D_1V_5	88.5[d]	28.1[b]	63.0[d]	39.9	44.1[d]	86.4
D_2V_1	110.8[b]	42.7[a]	67.7[c]	42.9	47.9[c]	213.7
D_2V_2	74.6[f]	30.6[b]	44.2[e]	43.3	40.9[e]	117.5
D_2V_3	69.7[f]	26.8[c]	43.0[f]	42.9	44.2[d]	113.7
D_2V_4	98.4[c]	38.7[a]	59.8[d]	44.7	46.7[c]	205.3
D_2V_5	62.1[g]	21.4[c]	39.5[f]	41.3	41.1[e]	120.6
D_3V_1	111.4[b]	25.6[c]	85.5[b]	46.0	48.1[c]	229.6
D_3V_2	85.7[e]	30.5[b]	55.8[d]	43.7	45.1[d]	124.0
D_3V_3	80.5[e]	23.7[c]	55.1[d]	43.3	44.7[d]	130.5
D_3V_4	107.6[b]	25.3[c]	81.9[b]	47.3	53.6[a]	238.1
D_3V_5	103.6[c]	41.4[a]	63.7[c]	45.1	49.5[c]	135.8
D_4V_1	122.8[a]	22.1[c]	104.2[a]	51.2	57.6[a]	311.9
D_4V_2	103.3[c]	23.1[c]	82.2[b]	44.3	51.5[b]	206.5
D_4V_3	105.8[c]	35.9[a]	71.7[c]	44.1	48.1[c]	159.2
D_4V_4	113.4[b]	27.2[c]	89.1[b]	49.7	53.6[a]	294.1
D_4V_5	71.4[f]	37.3[a]	65.6[c]	43.4	52.7[b]	161.0
GM	91.6	29.9	64.3	44.3	47.4	171.1
C.D (P=0.05)	7.5	7.0	8.2	NS	3.1	NS
CV (%)	5.0	14.2	7.7	5.1	4.0	10.8

similar line in *kharif* onion. Among the cultivars, the maximum bulb polar and equatorial diameters were measured in Indam Marshal, closely followed by Agrifound Dark Red. Haldar *et al*. (4) also reported similar trends. Interaction effect of planting date and variety on equatorial diameter was noted statistically significant. Agrifound Dark Red and Indam marshal, when planted on 30th September noted highest value of equatorial diameter.

Bulb yield

In any performance trial with various factors, yield is the most important character to be taken under special consideration. In the present investigation the yield had showed significant response under different dates of planting and cultivars. However, interaction effect was noted non-significant. The highest yield of 226.5q/ha was resulted when the transplanting was undertaken on 30th September, followed by planting on

15th September (171.6q/ha). Data on yield (Table 2) clearly revealed that progressive delay in planting from August to September was benefitted by linear increase in yield. Heavy rain was received in the month of August. The weather condition particularly rainfall and R.H. prevailed during early dates of planting might have some unfavorable influences, which caused the reduction of bulb yield. Variation in yield due to varied planting dates also reported by Sharma *et al*. (14) and Mahadeen (9). Agrifound Dark Red, like other yield attributing characters, produced the maximum yield of 235.2q/ha, closely followed by Indam Marshal (231.4q/ha). Jain and Sarkar (6) identified Agrifound Dark Red as highest yielder. The highest yield was produced by Agrifound Dark Red might be as indication of its suitability to grow in *kharif* season in lateritic belt of West Bengal. The interaction effect of planting dates and cultivars exerted on yield was not statistically significant. On an average the projected bulb yield was 171.1q/ha for the entire study.

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