

PERFORMANCE OF KHARIF ONION GENOTYPES UNDER DIFFERENT DATES OF PLANTING FOR PRODUCTIVITY AND ECONOMICS IN GANGETIC PLAINS OF WEST BENGAL

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ABSTRACT

Two sets of experiment were conducted at Mondouri (W.B.) during 2010-11 and 2011-12 to find out the suitable varieties and to standardize the date of planting for Kharif onion production in the Gangetic plains. During first year, eight varieties namely Agrifound Dark Red, Agrifound Light Red, N-53, Baswant -780, Arka Kalyan, Pusa Red, Nasik Red and Bombay Red were evaluated. After evaluation, three best performing varieties namely, Baswant -780, N -53 and Agrifound Dark Red were selected and transplanted on four different dates of planting (28 July, 18 August, 8 and 29 September) to identify the most suitable planting date for Kharif onion cultivation. Results indicated that maximum yield of 152.50 q ha⁻¹ was obtained from Baswant-780. In the second experiment highest plant height, neck diameter, weight of fresh bulb, diameter of bulb and maximum yield of 167.48 q ha⁻¹ was also obtained from Baswant-780 where the seedlings were transplanted on 8 September. Amongst the three varieties with different dates of planting, it revealed that the variety Baswant-780 followed by Agrifound Dark were found as the most suitable Kharif onion should be planted in between the second week of August and second week of September. The maximum net returns (₹. 217975 ha⁻¹) and B:C ratio (1.56) were obtained from variety Baswant – 780 planted on 8 September.

Key Words: Date of planting, Kharif onion, varieties, production, economics, West Bengal

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important commercial vegetable cum spice crop grown in India. Among the onion producing countries, India is the second largest producer of onion after China, with an area of 1087.26 thousand hectares producing 17511.10 thousand metric tons bulbs during 2011-12. In West Bengal onion is cultivated in an area of 21.68 thousand hectares producing 304.56 thousand metric tonnes of bulbs during the same year (Anon, 2012). During 2012-13, our country exported 1378545 MT of onion valued ₹. 117223.40 lakhs (APEDA, 2013). In India, onion is predominantly grown as a rabi season crop but to overcome the problem of non availability and sky touching price of onion during October to January, one has to go for cultivation of onion during the Kharif season. In Maharashtra, Gujarat, Karnataka and Andhra Pradesh Kharif onion accounts for about 30% of the total production (Mohanty *et al.*, 2000). Rainy season onion cultivation is a new strategy in northern, eastern and central India mainly to meet the demand of fresh bulb in off season. Most onion cultivars are very sensitive to photoperiod and their range of adaptation is limited. Thus, it is imperative to assess the stability in performance of recommended varieties of onion for a specific location, especially for Kharif onion. Rising of Kharif

onion crop through seedling is very difficult in northern plains because of very high temperature during June-July (Gupta *et al.*, 1999). Standardization of transplanting dates of onion seedlings means assessment of the effect of edaphic factors and environmental conditions in large scale on growth, bulb yield and bulb quality, which differ widely from one region to another. Thus, determined the optimum transplanting dates having vital role in maximizing growth, bulb yield and its quality of onion (Sharief *et al.*, 2013). Onion, being the major bulbous vegetable crop of high domestic and export demand, is assuming as an important crop of West Bengal and growing Murshidabad, Nadia and Hooghly districts. Growing onion in the Gangetic plains of West Bengal during Kharif season is a somewhat new strategy to be adopted, which is a very usual one in the Southern and Western part of our country. The present study was, therefore, designed to identify the most promising variety suitable for Kharif season and standardization of the time of planting for growing Kharif onion in Gangetic plains of West Bengal.

MATERIALS AND METHODS

The experiment was conducted at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India, during 2010-11 and 2011-12. The soil of experiment site was sandy loam in texture with

5.7 g kg⁻¹ organic carbon, 0.06% total nitrogen, available phosphorous 30 kg ha⁻¹, available potassium 115 kg ha⁻¹ and pH 6.5. The experimental site is under subtropical humid region with range of average temperature of 36°C (max.) to 24°C (min.) and average R.H. of 60% (max.) to 95% (min.) during the experimental period (June to September) of both the years. In the first phase, eight varieties namely, Agrifound Dark Red, Agrifound Light Red, N-53, Baswant -780, Arka Kalyan, Pusa Red, Nasik Red and Bombay Red were planted and evaluated in randomized block design with three replications. After selection of suitable three varieties namely, Agrifound Dark Red (V₁), Baswant -780 (V₂) and N-53(V₃) were planted on 28 July (P₁), 18 August (P₂), 8 September (P₃) and 29 September (P₄) and evaluated in factorial randomized block design with three replications. The recommended fertilizer dose of 150 kg N, 40 kg P₂O₅ and 50 kg K₂O ha⁻¹ was applied in the plots (3m X 3m). Seven weeks old seedlings were planted at 30 cm between lines and 10 cm within it. All other intercultural operations were done as and when necessary. Harvesting of bulbs was done at maturity stage. Biometrical observations and yield attributing characters were recorded from randomly selected 25 sample plants from each replication. The statistical analysis was done as per methods suggested by Panse and Sukhatme (1989). Economics of onion

was worked out based on the current market price of inputs and outputs.

RESULTS AND DISCUSSION

Performance of the varieties

Vegetative growth parameters: Amongst the different varieties, Agrifound Dark Red emerged with highest plant height (62.55 cm) as also reported by Mohanty *et al.* (2000). Varieties Baswant-780 (58.15 cm), N-53 (56.15cm), Agrifound Light Red (55.61 cm) and Bombay Red (56.29 cm) did not differ significantly among themselves in respect of plant height. The variety Agrifound Light Red produced the highest length of leaf (55.61 cm) followed by N-53 (52.32 cm) and least was in Pusa Red (43.08 cm). Number of leaves per plant was recorded highest as 8.83 in variety Nasik Red and lowest as 6.53 in Pusa Red. Highest leaf diameter was measured in Baswant-780 (0.75 cm) followed by Agrifound Dark Red (0.71 cm) and Bombay Red (0.68 cm). These similarities and dissimilarities among the varieties may be attributed to the variability in their genetic configuration as well as to their differential responses with respect to phenotypic expression various valuable characters as a result of interaction between the genotypic, edaphic and environmental factors. The highest pseudostem length was noted under Agrifound Light Red (6.87cm) followed by Bombay Red (6.50cm).

Table 1: Evaluation of Kharif Onion varieties in respect of vegetative growth and of yield attributes and yields of onion

Varieties	Plant height (cm)	Foliage length (cm)	Leaves /plant	Leaf diameter (cm)	Pseudostem length (cm)	Neck diameter (cm)	Weight of fresh plant (g)	Weight of fresh bulb (g)	Diameter of bulb (cm)	Yield (q ha ⁻¹)
Pusa Red	48.0	43.0	6.5	0.44	4.92	0.54	88.57	40.25	5.12	134.50
N-53	56.1	52.3	8.3	0.42	5.47	0.83	102.23	41.90	5.21	142.00
Baswant-780	58.1	51.4	8.1	0.75	6.48	0.79	101.27	46.65	5.37	152.50
Agrifound Dark Red	62.5	50.7	8.8	0.71	5.96	0.81	98.60	41.40	5.30	139.30
Agrifound Light Red	55.6	55.6	8.4	0.61	6.87	0.79	93.33	39.40	4.52	133.30
Nasik Red	47.3	47.3	8.8	0.59	5.15	0.74	92.07	27.70	4.19	95.00
Arka Kalyan	50.1	45.5	7.1	0.62	6.12	0.76	85.53	28.80	4.22	96.67
Bombay Red	56.2	51.3	7.5	0.68	6.50	0.82	81.23	26.00	3.91	85.67
S. Em. (±)	2.7	2.	0.35	0.03	0.69.	0.04	3.28	1.37	0.29	5.88
CD (P=0.05)	8.2	7.1	1.07	0.11	N S	0.12	9.96	4.15	0.90	17.85

Yield attributing characters: The neck diameter of fresh bulbs showed significant variation in all the varieties. The variety Pusa Red produced the lowest neck diameter of 0.54 cm where as the neck diameter showed by other seven cultivars were statistically at par. The range of mean fresh weight of plants

produced by the eight genotypes was 102.23 – 81.23, thus fresh weight of N-53 (102.23 g) and Bombay Red (81.23 g) differed significantly. Amongst the different varieties, Baswant-780 emerged as the best variety for producing the highest fresh bulb weight of 46.56 g closely followed by N-53 (41.90 g),

Agrifound Dark Red (41.40 g) and Pusa Red (40.25 g) however produced significantly lower fresh bulb weight than Baswant-780. The highest measure with respect to bulb diameter was obtained in Baswant-780 (5.37 cm) followed by Agrifound Dark Red (5.30 cm), N-53 (5.21 cm) and Pusa Red (5.12 cm). Bombay Red produced the bulb having lowest bulb diameter (3.91cm.). The highest bulb yield of 152.50 q ha⁻¹ was obtained from Baswant -780 followed by

N-53 (142.0 q ha⁻¹) and Agrifound Dark Red (139.3 q ha⁻¹). The results are not corroborated with the findings of Bhonde *et al.* (1992) where they observed that Agrifound Dark Red is the good yielder in the Nasik situation. But the climatic situation as well the soil characteristics of the present experimental locality might have suited the most to the variety Baswant - 780 among the three varieties under study, thus, it produced the highest yield.

Table 2: Effect of date of planting and variety on vegetative and yield attributing characters on *Kharif* Onion

Treatments	Plant height (cm)	Foliage length (cm)	Leaves / plant	Leaf diameter (cm)	Pseudostem length (cm)	Neck diameter (cm)	Fresh plant weight (g)	Fresh bulb weight (g)	Diameter of bulb (cm)	Yield (q ha ⁻¹)
P ₁ V ₁	50.2	43.1	6.69	0.72	6.47	0.71	100.74	50.29	5.11	145.46
P ₁ V ₂	54.2	46.4	8.02	0.70	7.01	0.79	103.57	54.23	5.34	156.35
P ₁ V ₃	48.6	41.7	7.98	0.49	8.05	0.76	87.01	48.66	4.18	126.79
P ₂ V ₁	56.5	48.7	7.62	0.78	7.42	0.77	108.50	56.57	5.40	170.54
P ₂ V ₂	55.4	48.1	7.86	0.73	8.41	0.79	109.71	55.47	5.64	176.55
P ₂ V ₃	54.1	46.2	7.96	0.51	8.36	0.78	96.13	54.16	4.82	145.00
P ₃ V ₁	55.4	50.0	7.33	0.78	6.76	0.76	114.82	55.48	6.19	166.21
P ₃ V ₂	58.2	47.1	8.33	0.70	8.41	0.78	105.61	58.29	6.31	178.92
P ₃ V ₃	52.8	47.2	8.27	0.52	8.22	0.77	100.30	52.84	4.92	157.30
P ₄ V ₁	50.6	43.4	6.47	0.75	6.78	0.77	103.87	50.65	5.45	149.67
P ₄ V ₂	54.9	46.5	8.31	0.70	8.12	0.80	102.91	54.91	5.48	152.9
P ₄ V ₃	48.2	40.3	8.02	0.54	8.07	0.70	91.88	48.27	4.05	128.45
S. Em. (±)	0.71	0.73	0.16	0.11.	0.14	0.015	1.65	0.12	0.12	2.96
C.D. at 5%	2.09	2.15	0.47	N.S.	0.43	0.043	4.86	0.37	0.37	8.69

P – date of planting, V – Kharif onion varieties for first phase of the experiment. P₁ - 28 July, P₂ - 18 August, P₃ - 8th September and P₄ - 29 September. V₁ - Agrifound Dark Red, V₂ - Baswant -780 and V₃ - N-53

Dates of planting

Vegetative growth parameters: The results revealed that the highest plant height of 55.54 cm was obtained from 8 September planting, very closely followed by 2nd planting date (18 August) with a plant height of 55.40 cm. The minimum plant height of 51.06 cm was recorded when the planting was done on 28 July (Table 2). As the planting was delayed gradually, the plants might have received more congenial weather condition for their growth and development. This might be an indication of suitability of late planting rather than early planting for *Kharif* onion in the Gangetic plains of West Bengal. The lower plant height in earlier planting (28 July) might be due to higher amount of rainfall occurred during this period. Baswant-780 produced the tallest plants (55.72 cm) which differed significantly from that of N-53. The differences in plant height among the three varieties might be due to interaction between their inherent genetic configuration and environmental condition prevailed during various dates of plantings. The maximum foliage length was recorded as 48.13 cm

when the seedlings were transplanted on 8 September, which is pretty much alike with the findings of Singh and Singh (2002). Where as, relatively lower foliage length was noted under 28 July (41.71 cm) and 29 September (40.33 cm). The rainfall and average temperature prevailed during August to second week of September might have positive influences on the growth of higher foliage length as comparison to very early and late planting on 28 July and 29 September, respectively. The different genotypes resulted in significant variations in foliage length. Among the three genotypes the maximum foliage length of 46.96 cm was obtained from variety Baswant-780 and minimum (40.33 cm) for variety N-53. The results showed a decreasing trend in the production of number leaves/plant during very early and late plantings. The lowest number of leaves/plant (7.56) was recorded with 28 July planting and 7.60 leaves/plant with 29 September planting and these two observations were statistically at par. The July and late September planting may have received some unfavorable climatic conditions which might have

attributed to the lower number of leaves production per plant. The variety Baswant-780, proved as the best, with respect of number leaves/plant (8.13), which was very closely followed the variety N-53 (8.06). Various planting dates have more or less similar effect on the character leaf diameter. The highest leaf diameter of 0.76 cm was noted in variety Agrifound Dark Red followed by 0.71 cm and 0.51 cm in variety Baswant-780 and N-53 respectively. The maximum pseudostem length of 8.06 cm was resulted when the planting was done on 18 August and this value had a significant difference the other

three plantings dates. These results are very much in similarity with the findings of Sharma *et al.* (2003) and Singh and Singh (2002). This variation in the pseudostem length due to different dates of planting might be caused due to the difference in the weather condition, mainly average temperature, rainfall and R.H. as well as due to the genotype-environment interaction. The highest pseudostem length of 8.17 cm was recorded in the variety N-53. This result is more or less identical with those of Sharma *et al.* (2003).

Table 3: Economics for treatments for *Kharif* onion cultivation

Treatment combinations	Yield (q ha ⁻¹)	Cost of cultivation (₹.ha ⁻¹)	Gross return (₹.ha ⁻¹)	Net Return (₹.ha ⁻¹)	Benefit : Cost ratio
P ₁ V ₁	145.46	139865	290920	151055	1.08
P ₁ V ₂	156.35	139865	312700	172835	1.24
P ₁ V ₃	126.79	139865	253580	113715	0.82
P ₂ V ₁	170.54	139865	341080	201215	1.44
P ₂ V ₂	176.85	139865	353700	213835	1.53
P ₂ V ₃	145.00	139865	290000	150135	1.08
P ₃ V ₁	166.21	139865	332420	192555	1.38
P ₃ V ₂	178.92	139865	357840	217975	1.56
P ₃ V ₃	157.30	139865	314600	174735	1.25
P ₄ V ₁	149.67	139865	299340	159475	1.14
P ₄ V ₂	152.92	139865	305840	165975	1.19
P ₄ V ₃	128.45	139865	256900	117035	0.84

Selling price of onion bulb = ₹ 20.00 kg⁻¹, Cost of onion seed = ₹ 2000.00 kg⁻¹, Cost of Urea = ₹ 7.50kg⁻¹, Cost of Single super phosphate = ₹ 16.50 kg⁻¹, Cost of muriate of potash = ₹ 24.50 kg⁻¹, Labour charge = ₹ 167.00 day⁻¹labour⁻¹

Yield attributing characters: Neck diameter was significantly influenced due to various dates of planting with different genotypes and maximum neck diameter (0.78 cm) was resulted when the planting was done on 18 August. This result has been confirmed by the findings of Singh *et al.* (2002). Among the varieties, the highest neck diameter of 0.79 cm was noted in Baswant-780. The maximum fresh plant weight of 106.01 g was obtained when transplanting was done on 8 September, followed by (104.78 g) 18 August transplanting. The lowest plant weight (97.11 g) was obtained in late July planting (28 July). Hence it is quite evident that the early and late planting both caused reduction in the weight. Among the varieties, Agrifound Dark Red produced the highest fresh plant weight of 109.98 g closely followed by Baswant-780 (105.43g). The different planting dates resulted in significant variation in weight of fresh bulb and maximum value (55.54 g) was obtained, with 8 September planting followed by second date of planting (55.40 g) indicating decreasing trend in fresh bulb weight. These results

are in conformity with the findings of Sharma *et al.* (2003) in onion cultivar N-53. The different genotypes resulted in significant variation in fresh bulb and maximum bulb weight was observed in variety Baswant-780 (55.72 g) which may can be attributed to the inherent variability that exists in different genotypes or may be due to the environmental effect. The greatest bulb diameter of 5.87 cm was obtained, 8 September planting closely followed by 18 August transplanting (5.29 cm). The lowest bulb was resulted from 28 July transplanting followed by last date of planting. Bulb diameter also showed decreasing trend as planting was delayed from 8 September to 29 September. Baswant-780 proved to be the best variety with respect of bulb diameter as it produced the bulb having maximum diameter of 5.69 cm. The variety N-53 may not be considered suitable variety in comparison to Baswant-780 and Agrifound Dark Red to be grown as *Kharif* onion in the plains of West Bengal. Various dates of planting showed a considerably variable effects on yield, which ranged from 167.48 to 142.37 q ha⁻¹. The highest yield of

167.48 q ha⁻¹ was recorded from the 8 September planted crop. These results corroborated with the findings of Singh *et al.* (2002) with cultivar N-53. The bulb yield of 164.03 q ha⁻¹ was noted when the planting was done on 18 August followed by 143.68 and 142.37 q ha⁻¹ in 29 September and 28 July planting, respectively. It was quite obvious that the decline in the bulb yield occurred due to early and late planting. The weather condition *viz.* maximum and minimum temperature, rainfall and R.H. prevailed early and late in the season might have some unfavorable influences, which caused the reduction in the total bulb yield. The variety Baswant-780 produced the maximum yield of 166.08 q ha⁻¹ followed by Agrifound Dark Red (157.97 q ha⁻¹) and the lowest yield in N-53 (139.38 q ha⁻¹). The

differences between yields produced by these three genotypes under this present investigation were statistically significant.

Economics: The highest benefit: cost ratio of 1.56 was obtained from variety Baswant-780, planted on 8 September and the least benefit: cost ratio (0.82) from the first date of planting (i.e. 28 July) of variety N-53. Net returns (₹. 217975 ha⁻¹) was highest with Baswant – 780 variety planted on 8 September. The minimum net return was observed from variety N-53 planted on 28 July.

It may be concluded from the present investigation that variety Baswant-780 planted on 8 September might be beneficial for achieving higher productivity and profitability in Gangetic plains of West Bengal.

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