



E-ISSN: 2278-4136

P-ISSN: 2349-8234

www.phytojournal.com

JPP 2021; 10(1): 2222-2225

Received: 19-11-2020

Accepted: 21-12-2020

Jaipinaki Sengupta

Department of Horticulture,
Faculty of Agricultural Sciences
and Technology, AKS
University, Satna,
Madhya Pradesh, India

Purnima Singh Sikarwar

Department of Horticulture,
Faculty of Agricultural Sciences
and Technology, AKS
University, Satna,
Madhya Pradesh, India

KR Maurya

Department of Horticulture,
Faculty of Agricultural Sciences
and Technology, AKS
University, Satna,
Madhya Pradesh, India

Binita Devi

Department of Horticulture,
Faculty of Agricultural Sciences
and Technology, AKS
University, Satna,
Madhya Pradesh, India

Studies on genetic variability for quantitative and qualitative traits in onion (*Allium cepa* L.)

Jaipinaki Sengupta, Purnima Singh Sikarwar, KR Maurya and Binita Devi

Abstract

The present investigation was carried out at experimental farm of Department of Horticulture, AKS University, Satna (M.P.) during *Rabi* season of year 2019-20. The experiment was conducted in Randomized Block Design having 12 (onion varieties) in three replications with 12 treatments. Twelve diverse varieties of onion collected from different sources and all the varieties are grown with three replications in 4 m² plot and the plant keeping 60 x 45 cm maintained between Row and Plant distance. They were evaluated for growth yield and quality attribute for all the traits. On the basis of overall findings of the present research study revealed that there is wide range of variation in onion traits for all the characters studied. The genotypes Bhima Raj (79.1667 cm) is highest in the plant height, No. of leaves/ plant (13.4667), Leaf diameter (6.7433 cm) and Bhima Shakti is highest in Neck diameter (3.9567 cm), Moisture (22.9333%). The maximum TSS was found in cv. Bhima Shubhra (13.3367°Brix). The genotype Bhima Super was found maximum Vit. C (mg /100g). The genotype Bhima Shweta recorded the highest average bulb weight (378.733 g), Bulb dry matter (171.00g), biological yield (7.5747kg/plot), Harvest index (4.5867), dry matter (5.300%) and economic yield (33.5367 tones/ha). The cultivar Bhima Shakti resulted in higher bulb yield per plot, economic yield and stand promising for cultivation under agro-climatic condition of Satna. The maximum genotypic and phenotypic coefficient of variation percent was reported for length of leaves and biological yield followed by plant height. High genetic advance was reported for dry weight of bulb followed by biological weight of bulb; however the maximum genetic advance as percent of mean was reported for bulb yield per plot and economic yield. Bulb yield per plot have positive significant correlation with fresh weight and dry weight both phenotypic and genotypic level.

Keywords: growth, yield, quality and onion

Introduction

Onion is the third most important crop after potato and tomato. It is found in most market of the world throughout the year and can be grown under wide range of Agro-climate condition. The maximum diversity of *Allium* species is found in a belt from Mediterranean basin to Iran and Afghanistan. Onion is cultivated mainly as annual for bulb production and biennial for seed production. It has very good medicinal value. Nutritive value of onion varies from variety to variety. Small sized onions are more nutritive than big ones. Its major value is in its flavour. Onion ranks medium in calorific value, low in protein and very low in vitamins. The perpetual demand of onions within the country and for the export has made it essential to supply onions round the year either from fresh harvest or from stocks.

When breeding for a particular set of growing conditions, it is highly important to know the use of local populations, since in them the relationships among yield components are balanced and in harmony with the effects of the specific climatic and edaphic factors. For a successful breeding program, the presence of genetic diversity and variability play a vital role. Genetic diversity is essential to meet the diversified goals of plant breeding such as breeding for increasing yield, wider adaptation, desirable quality, pest and disease resistance. Selection of genetically diverse parents in any breeding program is of immense importance for successful recombination breeding Anathan, and Balakrishnamoorthy [1]. The genetic divergence analysis estimates the extent of diversity existed among selected genotypes Mohnaty [7]. Precise information on the nature and degree of genetic diversity helps the plant breeder in choosing the diverse parents for purposeful hybridization Panse [9]. Improvement in yield and quality is normally achieved by selecting genotypes with desirable character combinations existing in the nature or by hybridization. Basically these techniques aim to improve a dependent character like yield when the independent characters have a significant relation in desirable direction and positive direct effect or indirect effect through other traits on the dependent characters.

Corresponding Author:**Jaipinaki Sengupta**

Department of Horticulture,
Faculty of Agricultural Sciences
and Technology, AKS
University, Satna,
Madhya Pradesh, India

The objective of this preliminary study was to examine the growth, yield and quality traits of onion genotypes in Satna.

Materials and Method

The material for the study comprised of 12 genotypes of onion, were collected from DOGR (Directorate of Onion and Garlic Research), PUNE (Table -1).

The cultivars were raised in field experiment in randomized block design with three replications in the Horticulture research farm, Department of Horticulture, AKS University, Satna (M.P.) during *Rabi* season of year 2019-20. About four week old seedlings were transplanted at a distance of 15 x 20cm between plants in 8m² plots.

Besides, the good agricultural practices and plant protection measures were applied time to time as recommended for

commercial tomato production. Five plants from each plot were randomly tagged and observations recorded on Plant height, No. of leaves/plant, Leaf diameter (cm.), Bolting percentage, Neck diameter (cm.), Average top weight (g.), Average bulb weight (g.), Bulb dry matter (g.), Biological yield (kg/plot), Economic yield (tones/ha.), Dry matter (%), Moisture (%), T.S.S. (%) and Ascorbic acid (mg/100g.). The data collected on different parameters during the course of investigation were subjected to statistical analysis as per method of analysis of variance Panse and Sukhatme^[10]. The significance and non-significance of the treatment effect were judged with the help of 'F' variance ratio test. Calculated 'F' value (variance ratio) was compared with the table value of 'F' at 5% level of significance. If calculated value exceeded the table value, the effect was considered to be significant.

Table 1: List of different Genotypes

S. No.	Name of Genotypes	Source	S. No.	Name of Genotypes	Source
1	1630	DOGR,(PUNE)	7	Bhima red	DOGR, (Pune)
2	Bhima Shakti	DOGR,(PUNE)	8	Bhima Safed	DOGR, (Pune)
3	Bhima Dark red	DOGR,(PUNE)	9	Bhima Shubhra	DOGR, (Pune)
4	Bhima Shweta	DOGR,(PUNE)	10	1624	DOGR, (Pune)
5	Bhima raj	DOGR,(PUNE)	11	1629	DOGR, (Pune)
6	Bhima Super	DOGR,(PUNE)	12	W-045	DOGR, (Pune)

Results and Discussion

In order to evaluate the listed genotypes the mean of twelve genotypes including check for twenty four Characters. Wide range of variation in mean performance of genotypes was

observed for all characters under study (Table 2 and 3). The mean performance was highly significant for all characters, suggesting that there is ample scope for selection in different traits for the improvements of onion.

Table 2: Mean Performance of onion genotypes for various characters

S. N	Genotypes	Plant Height (cm) at 30 DAT	Plant Height (cm) at 60 DAT	Plant Height (cm) at 90 DAT	No. of leaves/plant at 30 DAT	No. of leaves/plant at 60 DAT	No. of leaves/plant at 90 DAT	Leaf diameter (cm) at 30 DAT	Leaf diameter (cm) at 60 DAT	Leaf diameter (cm) at 90 DAT	Neck diameter (cm) at 30 DAT	Neck diameter (cm) at 60 DAT	Neck diameter (cm) at 90 DAT
1	1630	27.5067	58.7133	75.9200	5.3067	7.5433	11.1167	0.4667	2.6967	6.1333	0.8400	2.4900	3.8733
2	Bhima Shakti	37.1667	60.5067	74.2433	5.5333	8.8800	11.7133	0.6033	2.5533	5.9067	1.0633	2.3967	3.9567
3	Bhima Dark red	35.2800	59.8267	76.5133	4.5400	8.5700	11.1067	0.5367	2.8200	6.2400	0.8733	2.4433	3.6933
4	Bhima Shweta	31.2100	62.9800	76.2133	5.1167	8.5433	12.5767	0.5567	2.3167	6.2900	0.7767	2.3133	3.8233
5	Bhima raj	34.2800	61.8033	79.1667	5.9633	9.0700	13.4667	0.6467	2.2333	6.7433	0.9400	2.4900	3.5933
6	Bhima Super	29.7033	59.3867	73.3600	5.3367	9.2067	11.1133	0.5967	2.5700	5.9800	0.8567	2.4200	3.6800
7	Bhima Red	32.4133	59.6100	70.0033	5.4133	8.6467	12.9333	0.5833	2.2000	5.8000	0.7900	2.3033	3.6000
8	Bhima Safed	27.2467	57.6500	69.9367	5.1033	9.0000	11.8400	0.4867	2.3200	5.8233	0.7533	2.2100	3.3700
9	Bhima Shubhra	29.7067	57.8400	78.2767	5.1167	9.1300	11.6500	0.5633	2.7333	6.3667	0.8767	2.5833	3.7400
10	1624	30.6333	59.4833	72.5033	5.9100	8.2233	11.6733	0.6200	1.9833	5.9567	0.9600	2.1967	3.6367
11	1629	31.9833	59.2000	69.1867	5.4533	8.9867	12.9700	0.5533	2.7900	5.7400	0.8367	2.1367	3.3267
12	W-045	31.8167	61.3133	74.7700	5.2567	6.5500	12.6767	0.6067	2.6567	5.9500	0.9000	2.5067	3.9433
	Mean	31.5789	59.8594	74.1744	5.3375	8.5292	12.0697	0.5683	2.4894	6.0775	0.8722	2.3742	3.6864
	C.V.	10.3005	3.857	6.0594	10.603	14.6625	7.9682	11.6724	11.5853	6.1788	13.9733	5.0549	8.2935
	F ratio	2.4884	1.3909	1.5995	1.3393	1.1622	2.181	1.9163	2.6382	1.7923	1.5089	4.149	1.295
	F Prob.	0.0331	0.2449	0.1677	0.2686	0.3654	0.0576	0.0935	0.0254	0.1176	0.1979	0.0022	0.2904
	S.E.	1.878	1.333	2.5949	0.3267	0.722	0.5553	0.0383	0.1665	0.2168	0.0704	0.0693	0.1765
	C.D. 5%	5.5079	-	-	-	-	-	-	0.4884	-	-	0.2032	-
	C.D. 1%	7.4862	-	-	-	-	-	-	0.6638	-	-	0.2762	-
	Range Lowest	27.2467	57.6500	69.1867	4.5400	6.5500	11.1067	0.4667	1.9833	5.7400	0.7533	2.1367	3.3267
	Range Highest	37.1667	62.9800	79.1667	5.9633	9.2067	13.4667	0.6467	2.8200	6.7433	1.0633	2.5833	3.9567

Table 3: Mean Performance of onion genotypes for various characters

S. N	Genotypes	Bolting percentage	Average top weight (g.)	Average bulb weight (g)	Bulb dry matter (g.)	Biological yield (kg/plot)	Harvest index	Dry matter (%)	Moisture (%)	TSS (Brix)	Vit. C (mg /100g)	Bulb yield per plot (kg)	Economic yield (tones/ha.)
1	1630	6.4000	38.6333	232.167	101.667	4.6437	2.0533	3.8667	21.8667	12.1533	11.7167	6.9367	24.9967
2	Bhima Shakti	6.2000	38.5333	356.300	126.00	7.1260	4.0533	5.1000	21.300	11.4200	10.8433	5.8533	30.1800
3	Bhima Dark red	6.4000	31.8667	285.067	108.00	5.7013	2.9533	3.9333	22.2667	11.0333	10.5433	5.8633	26.1667
4	Bhima Shweta	6.4667	42.2667	378.733	171.00	7.5747	4.5867	5.3000	21.5333	11.9300	10.9967	6.1700	33.5367
5	Bhima raj	7.0667	38.6000	321.067	136.00	6.4227	4.1100	4.9333	22.9333	11.7467	11.0700	5.5700	27.1133
6	Bhima Super	5.9333	43.2000	306.100	102.667	6.1220	3.6733	4.9000	21.3667	12.5200	12.1633	5.9367	22.6000
7	Bhima Red	6.6000	36.5000	261.033	105.333	5.2207	2.7333	4.2333	21.1667	11.6967	11.4200	6.3900	23.0933
8	Bhima Safed	6.1667	39.6967	217.167	96.6667	4.3433	2.9233	4.2000	22.4667	12.0533	10.9367	6.0200	28.0333
9	Bhima Shubhra	5.0333	40.0867	219.600	107.667	4.3920	2.4333	5.1667	21.9667	13.3367	10.9467	5.8067	24.1067
10	1624	6.8000	37.6667	371.833	120.667	7.4263	4.1467	3.7000	22.6667	12.4100	10.7467	5.3667	30.6300
11	1629	6.7333	40.9867	226.733	79.6667	4.5347	2.6533	3.9667	21.9667	11.5933	11.4767	5.5767	23.5400
12	W-045	6.2000	38.9267	231.667	98.6667	4.6350	3.3300	4.2333	22.2333	11.900	11.1267	5.6967	25.9833
	Mean	6.3333	38.9136	283.956	112.833	5.6785	3.3042	4.4611	21.9778	11.9828	11.1656	5.9322	26.665
	C.V.	10.514	12.3236	11.4072	14.2864	11.3978	13.6595	13.6067	3.7537	8.1413	4.7483	6.0376	13.9562
	F ratio	1.8001	1.106	10.8202	6.3511	10.8153	9.4291	2.7039	1.393	1.1048	2.1993	4.1297	2.4903
	F Prob.	0.1159	0.4015	0	0.0001	0	0	0.0226	0.244	0.4023	0.0557	0.0023	0.033
	S.E.	0.3845	2.7687	18.7012	9.3068	0.3737	0.2606	0.3505	0.4763	0.5632	0.3061	0.2068	2.1486
	C.D. 5%	-	-	54.8486	27.2957	1.096	0.7642	1.0279	-	-	-	0.6065	6.3015
	C.D. 1%	-	-	74.5488	37.0996	1.4896	1.0387	1.397	-	-	-	0.8243	8.5648
	Range Lowest	5.0333	31.8667	217.1667	79.6667	4.3433	2.0533	3.7000	21.1667	11.0333	10.5433	5.3667	22.6000
	Range Highest	7.0667	43.2000	378.7333	171.0000	7.5747	4.5867	5.3000	22.9333	13.3367	12.1633	6.9367	33.5367

The range for plant height varied from maximum (37.1667) Bhima Shakti to minimum Bhima Safed (27.2467). The maximum No. of leaves/ plant the genotypes is that (13.4667) Bhima raj and the minimum No. of leaves/ plant the genotypes (11.1067) Bhima Dark red. The maximum Leaf diameter (cm) is observed in (6.7433) Bhima raj and the minimum Leaf diameter (cm) is found in the genotypes 1629 (5.7400). The mean performance of genotypes indicated that maximum Neck diameter cm (3.9567) Bhima Shakti and minimum in 1629 (3.3267). The maximum Bolting percentage was observed in the genotypes Bhima raj (7.0667) and minimum in Bhima Shubhra (5.0333). These findings were in accordance with the result obtained by Dehdari *et al.* [2], Golani *et al.* [3], Dhotre *et al.* [4], Navaldey *et al.* [8] and Singh and Singh [11] in onion. The maximum top weight (43.2000g) Bhima Super and minimum top weight in Bhima Dark red (31.8667g). The maximum bulb weight was recorded in Bhima Shweta (378.733g) and minimum in Bhima Safed (217.167g). The maximum average Bulb dry matter was found in (171.00g) Bhima Shweta and minimum in (79.6667g) 1629. The Highest Biological yield (7.5747 kg/plot) was observed in Bhima Shweta and lowest found in the genotypes Bhima Safed (4.3433 kg/plot). The highest Harvest index was found (4.5867) in Bhima Shweta and minimum in 1630 (2.0533). The maximum Dry matter (5.30%) was found in Bhima Shweta and minimum in (3.70%) 1624. The Moisture (22.93%) was found maximum in Bhima raj and minimum in (21.16%) Bhima Red. The highest Total soluble solids found in Bhima Shubhra (13.33 °Brix) and the minimum was recorded in the genotypes Bhima Dark red (11.03 °Brix). The observation of ascorbic

acid recorded maximum in Bhima Super (12.1633 mg /100g) and minimum in (10.5433mg /100g) Bhima Dark red. The Bulb yield per plot (6.9367kg) recorded maximum in 1630 and minimum in 1624 (5.3667 kg). The highest Economic yield (33.5367tones/ha.) found in Bhima Shweta and lowest in (22.6000 tones/ha.) Bhima Super. Similar finding were also reported by Haydar *et al.* [5], Mallikarjun *et al.* [6] and Taylor *et al.* [12]. These characters are therefore governed by additive gene effects. Selection on the basis of these characters will be more useful for the improvement of this crop towards attaining higher yield.

Conclusion

On the basis of overall findings of the present research study it was concluded that there is wide range of variation in onion genotypes for all the characters studied. Bhima Shweta was superior from the other genotypes in term of vegetative growth, yield parameters and quality of onion. There for these characters should be given priority cheekily during selection for genetic improvement of onion.

References

1. Anathan M, Balakrishnamoorthy G. Genetic variability and correlation studies in onion (*Allium cepa* L.) for economic dry matter yield. *Agricultural Science Digest* 2007;27(3):190-193.
2. Dehdari A, Rezai A, Mobli M. Morphological and agronomic characteristics of landrace varieties of onion (*Allium cepa* L.) and their classification. *J Sci Tech Agric. Nat. Res* 2001;5(2):109-124.

3. Golani IJ, Vaddoria MA, Mehta DR, Naliyadhara MV, Dobariya KL. Analysis of yield component in onion Indian J Agric Res 2006;40(3):224-227.
4. Dhotre M, Allolli TB, Athani SI, Halemani LC. Genetic variability, character association and path analysis studies in kharif onion (*Allium cepa* L.). Asian J Horti 2010;5(1):143-146.
5. Haydara A, Sharker N, Ahmed MB, Hannan MM, Razvy MA, Hossian M *et al.* Genetic variability and Interrelationship in onion (*Allium cepa* L.). Middle-East. J Res 2007;2(3-4):132-134.
6. Mallikarjun D, Allolli TB, Hulihalli UK, Athani SI. Genetic diversity studies in *kharif* onion (*Allium cepa* var. *cepa* L.). Karnataka J Agric Sci 2010;23:811-812.
7. Mohnaty BK. Genetic variability, correlation and path analysis in onion seed crop. Indian. J Horti 2000;57(4):329-333.
8. Navaldey BR, Meena RB, Yogita ML. Genetic variability studies in onion (*Allium cepa* L.). Ann Horti 2011;4(2):171-175.
9. Panse VG. Genetic of quantities characters in relation to plant breeding. Indian J. Genetics 1957;17:318-328.
10. Panse VG, Sukhantme PV. The application of genetics to plant breeding inheritance of quantitative characters and plant breeding. J Genet 1957;40:283-302.
11. Singh D, Singh VK. Genetic variability, heritability and correlation studies on onion (*Allium cepa* L.). Genotypes. Research in environment and life sciences 2016;10(2):16-19.
12. Taylor A, Teakle GR, Walley PG, William EF, Jackson AC, Jones JE *et al.* Assembly and characterisation of a unique onion diversity set identifies resistance to *Fusarium* basal rot and improved seedling vigour. Theoretical and Applied Genetics 2019;132:3245–3264.