

Research
Paper

Genetic improvement of yellow onion (*Allium cepa* L.) for bulb development

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ABSTRACT

The present investigation was undertaken during late *Kharif* of 2003-03 with an objective to develop new yellow onion genotypes (from parental population of cv. PHULE SUVARNA by open pollination synthetic lines) variability for all floral and seed character. The study revealed that the rapid bulb development was noticed in selected population at all various crop stages (75-110 DAT) over parental population and showed significant difference in average performance and variability. Similarly, all bulb character of selected population showed improvement over parental population by displaying different performance and variability between two population. More importantly export oriented bulb production of yellow onion was noticed in selected population with mean of equatorial bulb diameter 6.34 cm and mean bulb weight of 206.18 g.

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Key words : Genetic, Genotypes, Hetrozygosity, Plant height, Leaves

INTRODUCTION

Maharashtra is the leading onion (*Allium cepa* L.) growing state accounting for 25 per cent total production (1661.0 thousand tones) and 16 per cent of the total area (84.48 thousand ha). India is the second largest producer of onion with an area of 454.6 thousand ha and production 6034.25 thousand MT (Anonymous, 2005). Onion is predominately a *Rabi* season crop of India but in Maharashtra it can be grown year round under wide range of climatic condition, Phule Suvarna is basically a *Rabi* season variety developed by Mahatma Phule Krishi Vidyapeeth, Rahuri. Especially for exporting yellow onion bulb are generally harvested in the month of March to April (Anonymous, 1997).

However, onion export initiates from December onwards, therefore, *rangda* onion cultivation can be exploited for export. However, cv. PHULE SUVARNA is a moderately susceptible to pre-mature bolting during late *Kharif* season, hence, it was important to manipulate the cv. PHULE SUVARNA genetically so that improved strain can be suitable for late *Kharif* season.

MATERIALS AND METHODS

The investigation was carried out at the Instructional

cum Research Farm, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.) during late *Kharif* 2002-03. The plot selected for the experiment had a uniform soil depth and fertility. The soil was light to medium black and well drained. Selection of promising genotypes of yellow onion was done especially suitable to late *Kharif* (*i.e. rangda*) season. Selection pressure was applied at two stages on desirable horticultural traits particularly for *rangda* season such as controlled vegetative growth coupled with rapid bulb development, bigger bulb size and resistance against premature bolting and twin bulbs. Accordingly, initially on the basis of plant growth characters, 250 seed bulbs were selected from plant population of one lakh bulbs and thus, 0.25 per cent selection pressure was applied on original plant population. However, at bulb harvesting stage from 250 initial selection only 25 seed bulb finally selected to advance bulb crop on the basis of desirable bulb character such as natural top fall, thin bulb neck, shape and size of bulb. However, to maintain brode genetically and hetrozygosity of onion crop, random mating of initially selected 250 bulb was allowed during seed production programme.

During late *Rabi* season, these seed bulb were planted on 19th January, 2003 and seed production was undertaken in isolation where random pollination or sib

mating of 250 selected bulb was allowed. The seed of each mother plant was harvested separately as a synthetic selection on 5th May, 2003. However, seed of finally selected 25 genotypes were used to raise bulb crop during late *Kharif* (rangda) season of 2003-04. The recommended dose of 20 tons/h of farm yard manure and 50 kg K₂O in the form murate of potash per hectare was applied as a basal dose at the time of transplanting. The 50 kg/ha nitrogen in the form of urea was applied as a top dressing followed by light earthening up upon 30 DAT (days after transplanting) stage. Phule Suvarna was statically analyzed by t test for average performance and by F test for genetic variability (Panse and Sukhatme, 1967).

RESULTS AND DISCUSSION

While evaluating bulb crop, plant growth character, bulb development at various growth stages , bulb characters and additionally per cent premature bolting and natural top fall at different crop stages were studied

Among plant growth character, significant variation between selected and parental population was noticed for character plant height where more plant height was recorded in selected population (55.25 cm) than control one 51.91 cm (Table 1). Thus early and vigorous plant growth was observed in selection population than parental one (12.96), it indicated that secondary vegetative phase would not active in selection population. More importantly, rapid bulb development was noticed in selection population than parental one when it was assessed at 4 different crop stages from 75 to 105 DAT. Therefore, selected

Tabal 1 : Characterization of bulb crop for plant growth

Character/test	Plant height at 75		No. of leaves at 75	
	DAT (cm)		DAT (cm)	
	S	C	S	C
Mean	55.25	51.91	12.36	12.96
Rang	49.00	49.29	9	9
Std dev	64.2	59.1	16	17
Observation	3.60	3.97	1.84	2.38
df for `t,	125	25	125	25
`t, (cal)	148		148	
`t, (table)	4.15		1.38	
Result	1.96		1.96	
df for`f,	S		N	
`f, (cal)	124,24		124,24	
`f, (table)	17.24		1.93	
Result	2.21		2.21	
	S		N	

DAT : Days after transplanting, S-Significant, N- Non significant

population showed significantly different performance and variability than parental population. This phenomenon was of vital importance for early maturity and production of marketable bulbs especially during late *Kharif* onion cultivation. Significant variation was recorded for average performance and variability between two populations. More precisely, export oriented bulb parameters were recorded in selected population *viz.*, equatorial bulb diameter was ranged in between 4.9 to 7.5 cm with mean of 6.34 cm while bulb weight ranged from 190-225 g with mean pf 206g (Table 3). These results are in conformity with those reported by Patil *et al.* (1986) and Satodiya

Table 2 : Assessment of bulb development during various crop stages

Character /test	Bulb development (equatorial bulb diameter in cm)							
	75 DAT		85 DAT		95 DAT		105 DAT	
	S	C	S	C	S	C	S	C
Mean	5.07	4.09	5.16	4.51	6.16	4.87	6.81	5.32
Range	4.6	3.1	5.2	3.5	5.5	3.9	6.1	4.3
Std. Lev.	5.5	4.6	6.1	5.3	6.8	5.7	7.5	6.0
Observation	0.20	0.54	0.21	0.49	0.25	0.46	0.30	0.42
Df for `t,	125	25	125	25	125	25	125	25
`t, (cel)	148		148		148		148	
`t, (table)	15.37		18.03		19.91		21.03	
Result	1.98		1.98		1.98		1.98	
Df. for `f,	S		S		S		S	
`F, (cal)	124,24		124.21		124.24		124.24	
`f, (table)	236.51		325.29		196.62		442.43	
Result	2.21		2.21		2.21		2.21	
	S		S		S		S	

S-Significant, N-Non significant

Table 3 : Characterization of bulb crop for various bulb characters

Character /test	Bulb diameter				Bulb neck thickness		Bulb weight	
	Equatorial (cm)		Polar (cm)		(cm)		(cm)	
	S	C	S	C	S	C	S	C
Mean	6.34	5.00	5.73	4.79	1.22	1.94	206.18	120.80
Range	4.9	3.9	4.8	3.9	0.8	1.6	190	105
	7.5	6.1	7.5	6.1	1.5	2.4	225	135
Std. Lev.	0.82	0.82	0.83	0.80	0.17	1.22	9.00	10.96
Observation	125	25	125	25	125	25	125	25
Df for `t,	148		148		148		148	
`t, (cel)	7.43		5.20		17.81		41.74	
`t, (table)	1.98		1.98		9.98		1.98	
Result	S		S		S		S	
Df. for `f,	124.24		124.24		124.24		124.24	
`F, (cal)	55.31		27.11		317.22		1742.52	
`F, (table)	2.21		2.21		2.21		2.21	
Result	S		S		S		S	

S-Significant, N-Non significant

and Singh (1997).

Data presented in Table 3 revealed that for all the bulb characters selected population displayed significant variation in average performance and variability than the control population as t and F test were significant. Higher mean values were recorded by selected population in character viz., equatorial and polar diameters (6.34 cm and 5.73 cm) bulb weight (206.18g) than the control population (5.00 cm, 4.79 cm and 120.80g, respectively). While lower bulb neck thickness (1.22 cm) was recorded by selected population than control (1.94 cm). Thus, desirable bulb characteristics were found in selection population which showed effectiveness of selection pressure applied for development of promising genotypes of yellow onion suitable for late *Kharif* season. Similar results were reported by Singh and Singh (2002).

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