

## EXPLOITING GENE EFFECTS FOR IMPROVING BULB YIELD IN ONION

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### ABSTRACT

The results of the studies conducted by Joshi and Tandon [1] suggested the possibilities of exploiting fixable heterosis in the form of general gene effects and additive  $\times$  additive type of gene interaction in cross combination IN-13  $\times$  L 43 for the genetic improvement and bulb yield in onion. This genetic information helped in the development and release of first high yielding open pollinated onion variety 'VL Piaz 3' for the hill region of U.P.

**Key Words :** Onion, gene effects, gca, sca, combining ability

The present paper deals with an example of translating findings of one of the studies on gene action in onion [1] in evolving a high yielding strain of onion which has been released under the name 'VL Piaz 3' for commercial cultivation in the hill region of Uttar Pradesh during 1993.

Research work for genetic improvement in onion was initiated at Vivekananda Parvatiya Krishi Anusandhan Shala (VPKAS), Almora in 1948. In the beginning, a number of Indigenous and exotic collections were evaluated and crosses were attempted among the superior germplasm. These efforts led to the development of several heterotic combinations [3].

### MATERIAL AND METHODS

For genetic improvement in onion, five red-skinned open pollinated populations namely, 'N 404' (L 35), 'Pusa Red' (L 36), 'Red globe' (L 37), 'Kanpur Red' (L 42) and 'Almora selection 2' (L 43), as male were crossed to four exotic yellow-skinned cytoplasmic male sterile inbred lines, namely, 'KyG 2129' (In-13), 'KyG 5546' (In-47), 'YGD 15-108' (In-9) and 'BYG 2207' (In-13) in design II of Comstock and Robinson [2]. Twenty F1's thus produced and their 9 parents were evaluated in randomized block design at two locations in U.P. hills, namely, VPKAS farm, Hawalbagh and

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erstwhile wheat research station, Bhowali. The results of this study indicated positive and significant estimate of heterosis over the better parent for bulb yield in inbred 13 × L 43. Besides, the specific combining ability estimate (SCA) in this cross combination was also observed to be significant. The general combining ability (GCA) effects of the parents of Inbred 13 × L 43 were also positive and high in magnitude for bulb yield (Table 1) in the study conducted by Joshi and Tandon [1]. In the

**Table 1. Values for combining ability effects of the parents (gca) and crosses (sca) for bulb yield in onion**

		'L 35'	'L 37'	'L 42'	'L 43'	gca of females
'In 3'	A	+0.165	+0.235	+0.123	-0.525*	-0.355*
	B	-0.127	+0.338	+0.123	-0.167	-0.253*
	P	+0.082	+0.241*	+0.096	-0.374**	-2.666**
'In 7'	A	-0.282	+0.190	-0.248	+0.130	-0.170
	B	-0.455*	-0.095	-0.248	+0.130	-0.170
	P	-0.312**	+0.133	-0.002	+0.234*	-0.268**
'In 9'	A	+0.508*	-0.202	-0.064	-0.242	+0.302*
	B	+0.670**	-0.010	-0.466**	-0.360*	+0.320**
	P	+0.418**	+0.001	-0.212	-0.272*	+0.262**
'In 13'	A	-0.345	-0.175	+0.233	+0.685**	+0.155
	B	-0.098	-0.088	+0.162	+0.520**	+0.288**
	P	-0.184	-0.219	+0.216	+0.315**	+0.274
gca of males		-0.198	+0.232	-0.106	+0.72	
		-0.155	+0.165	-0.185	+0.135	
		-0.216**	+0.159	-0.166	+0.314	

\*Significant at 5%, \*\*Significant at 1% level; A, Almora; B, Bhowali; P, Pooled

present study, the F1 between In-14 × L 43 used as a base material was advanced to F2 and subjected to three cycles of mass selection, subsequently, for bulb yield, skin colour, shape and size. A new strain 'VL 3', thus, evolved was maintained by random mating in isolation applying mild selection pressure for bulb yield and other important agronomic traits.

## RESULTS AND DISCUSSION

Joshi and Tandon [1] observed possibilities of exploiting fixable heterosis in the form of general gene effect and additive × additive type of gene interaction in a

cross combination 'In-13 × L-43'. This cross exhibited highly significant heterosis over the better parent at Almora and in pooled analysis and had high positive value at Bhowali. Three cycles of mass selection of the F<sub>2</sub> of this combination led to the development of an improved high yielding onion strain 'VL 3'. This high yielding open pollinated variety, designated as 'VL Piaz 3' was identified by All India Vegetable Improvement workshop during 1990 for hills and plains of U.P., has been released by U.P. State Varietal Release Committee in 1993 for general cultivation. In 11 trials (5 all India, 1 standard varietal trial and 5 station trials), conducting during 1979-80 to 1989-90 at Hawalbagh (Almora), it produced a mean bulb yield of 407.91 q/ha which was 47.4 to 20.6% higher over the recommended checks (Table 2).

**Table 2. Performance of VL 3 in comparative trials conducted in U.P. hills during 1979-80 to 1989-90 against recommended checks**

Variety	No. of trials	Mean bulb yield (q/ha)	% increase
VL 3 vs Arkaniketan	5	391.9	22.80
		319.2	
VL 3 vs Line 102	4	453.9	29.10
		351.6	
VL 3 vs Pusa Red	3	411.6	25.79
		327.3	
VL 3 vs N-2-4-1	2	365.9	20.60
		303.4	
VL 3 vs Local	5	388.4	36.46
		284.6	
VL 3 vs Pusa Ratnar	1	414.8	47.40
		281.5	

Apart from higher yield potential, it combines a fairly good level of field tolerance to most important disease and a insect pest of the region, namely, purple blotch and thrips and a less bolting habit. It produces medium- sized flattish globular-shaped, close-necked tightly skinned light red bulbs. In mid-hills the ideal time for sowing 'VL Piaz 3' nursery is second fortnight of October. Bulbs can be harvested in May after transplanting 15-20 days old seedlings during second fortnight of November. Bulbs may be planted by first week of October to harvest seed by first week of June before onset of monsoon. Cultivators can multiply its seed like their own traditional cultivars after taking few precautions such as isolation distance

and timely roguing of off-type plants/bulbs. Owing to its various desirable characteristics 'VL Piaz 3' offers a tremendous scope in increasing onion yields in the hill region of U.P., particularly in the remote areas where seed supply of improved varieties is almost negligible.

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