

Evaluation of Rajmash (*Phaseolus vulgaris*) Germplasm for increasing Productivity to Improve the Economic condition of Hill Farmers of Jammu and Kashmir

Vishal Raina^{1*}, Neeraj Kotwal², Narinder Panotra³, Rohit Sharma², Mahital Jamwal⁴ and Pardeep Wali⁴

¹Mega Seed Project, Directorate of Research, SKUAST-Jammu, (J&K), India.

²Regional Horticulture Research Station, Bhaderwah, SKUAST-Jammu, (J&K), India.

³OFRC, SKUAST-Jammu, (J&K), India.

⁴Directorate of Research, SKUAST-Jammu, (J&K), India.

(Corresponding author: Vishal Raina*)

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ABSTRACT: The pole type varieties of Rajmash are grown in the temperate region of Union Territory of Jammu and Kashmir as an intercrop with maize. The prevalent local cultivars of pole type Rajmash germplasm is a mixture - having low productivity and prone to diseases therefore purification of local land races was required. The different genotypes of Rajmash (*Phaseolus vulgaris* L.) germplasm were collected and evaluated during the kharif season of 2012-2014 for increasing the productivity and income of hill farmers. Rajmash germplasm (23 pole type accessions) from different regions of erstwhile Doda district (Bhaderwah, Dakshin, Marwah, Chatroo, Jalgaon, Chinta, Kansar, Manthal, Chirralla, Nalthi, Gwari and Sartangal) were collected. Selected germplasm was subjected to evaluation based on pure line selection. Individual single plants were selected and pure line selection trials were laid at Sartangal research farm of RHRSS-Bhaderwah, SKUAST-Jammu. The following four selections showed promising results - BR 104, BR 101, BR 303 and Br 307. The maximum yield was recorded (7.83 q/h) in BR 104 genotype while the minimum was recorded (3.89 q/ha) in BR 303.

Keywords: Rajmash, *Phaseolus vulgaris*, Pureline selection.

INTRODUCTION

India is the largest producer and consumer of pulses. Pulses (Chick pea (Bengal gram), lentils (Masoor), Pigeon pea (Arhar), lobiya, red kidney bean (Rajmash), Black gram (Urd/Mash), etc. - harvested for dry seeds are rich in proteins and other nutrients. Pulses are the main source of protein for predominantly vegetarian population of India (Hayat *et al.* 2014). Pulse cultivation enriches soil for sustainable production due to its nitrogen fixing characters and improves soil health. Pulse production in India in the year 2019-20 was 23.03 million tons and is estimated to be 25.58 million tons in 2020-21 (PIB, Delhi, 2021). Besides this India has to import pulses for its sizeable population and production needs to be increased. Improved high yielding varieties are required to fill the gap of production and consumption.

Bhaderwah Rajmash –a pulse grown in temperate regions of Doda (UT of J&K) is famous for its unique taste and flavour.

It is known for its good cooking qualities, sweetness, easy digestibility and colour, and is in high demand in market. *Rajmash* of other regions are sold in the market on the tag name of Bhaderwah *Rajmash*. Bhaderwah *Rajmash* is a pole type variety which is grown as an intercrop with maize as it requires staking for its growth and the Maize crop provides natural staking. *Rajmash-Phaseolus vulgaris* L (kidney bean) is a herbaceous plant grown for its edible dry beans. Bhaderwah *Rajmash* is a trailing pole type variety. The *Rajmash* harvesting is completed in the of last week of August to September before the maize harvesting. This intercrop combination of nitrogen fixing legume crop and maize enriches soil health and helps in soil conservation in sloppy hilly terrains (Alemayehu *et al.*, 2017, Duchene *et al.*, 2017). This is a traditional agricultural practice adopted since ages in this region. Bhaderwah *Rajmash* has indeterminate growth habit and bears alternate, green leaves, divided into three oval, smooth-edged leaflets.

The plant height is 3-4 m, stem and leaf colour is green, the flower colour is white, flower wing colour is white, pod colour (at maturity) is pale yellow and green when raw. The flowering is non-synchronous, leaf shape is cordate, seed shape is kidney shaped and the lower pods mature early. Rajmash commercially is grown in temperate areas having elevation between 1500-2500 m of sea level. If temperature falls below 10°C plant growth ceases and temperature above 35°C results into buds and flower drop, the ideal range is between 16-24°C. Excessive rain and water logging is detrimental to the crop. It requires cool dry weather. Rains in excess cause flower drop and spread of leaf spot diseases. The optimum relative humidity is 60-70%. As it is grown with maize as intercrop, the hampered light availability increases the growth of Rajmash plant. It requires bright sunny locations for its cultivation. Strong winds with high velocity cause lodging of supportive crop (maize) and damage the Rajmash plant. The strong winds also tend to increase the flower drop. For optimum growth and yield, well drained clay loam soil is best. The crop is sensitive to salinity. The crop is grown successfully in soils whose pH ranges from 5.2-5.8. Soils rich in organic matter promote better vegetative growth. It is highly self pollinated crop (Choudhary *et al* 2018; Singh *et al.*, 2014; Graham and Ranalli 1997; Yohannes *et al.*, 2020).

MATERIAL AND METHODS

Rajmash germplasm (23 pole type accessions/local land races) from different regions of erstwhile Doda district (Bhaderwah, Dakshin, Marwah, Chatroo, Jalgaon, Chinta, Kansar, Manthal, Chiralla, Nalthi, Gwari and Sartangal) were collected. Selected germplasm was subjected to evaluation based on pureline selection (Warming & Johannsen, 1895). Individual single plants were selected and pure line selection trials were laid at Sartangal research farm of RHRSS-Bhaderwah, SKUAST-Jammu, Jammu. Out of these 23 pole type accessions six lines which were promising and have yield potential are described in Table 1.

The collection of land races was made in 2007 and 2008 and subsequently grown in 2008 onwards. The collected germplasm were mixtures of Rajmash seeds of different colours, shapes and sizes. Single plant selections of plants within progenies of single plant showing good vigour were made and evaluated every year i.e. in 2009, 2010, 2011, 2012, 2013 and 2014 following pure line selection. The trials were laid for yield potential and other characters. The promising purelines so obtained are performing well (Devi *et al.*, 2015, Kumar *et al.*, 2014, Meena *et al.*, 2017). The rajmash-maize intercropping gives good economic returns to the farmers (Kumar *et al.*, 2017, Charak *et al.*, 2012) and also helps in checking soil erosion in hilly areas.

Table 1: Growth parameters of different genotypes of Rajmash (*Phaseolus vulgaris*) at harvest stages.

T. No.	Location	Seed colour	No. of days to 50% flowering	No. of pods per plant	No. of seeds per pod
BR 101	Gwari, Bhaderwah	Light red	78	11.67	1.0
BR 104	Lanchan, Bhaderwah	Maroon	79	13.67	1.0
BR 105	Chinchora, Bhaderwah	Medium red	78	10.00	1.0
BR 301	Chatroo, Kishtwar	Medium red	77	9.67	0.9
BR303	Kansar, Bhaderwah	Medium red	78	13.00	1.1
BR 307	Chiralla, Doda	Medium red	80	11.67	1.0
SE(m)		-	0.236	1.572	1.523
CD at 5%		-	0.752	5.017	4.862

Table 2: Growth attributes of different genotypes of Rajmash (*Phaseolus vulgaris*) at harvest stages.

T. No.	Location	Pod length (cm)	Seed length (cm)	100 Seed wt. (g)
BR 101	Gwari, Bhaderwah	8.20	1.00	29.74
BR 104	Lanchan, Bhaderwah	9.07	1.00	32.24
BR 105	Chinchora, Bhaderwah	9.17	1.03	29.91
BR 301	Chatroo, Kishtwar	9.50	0.93	29.04
BR303	Kansar, Bhaderwah	8.17	1.10	30.71
BR 307	Chiralla, Doda	8.00	1.03	30.17
SE(m)		0.195	0.054	0.608
CD at 5%		0.623	N/A	1.941

RESULTS AND DISCUSSION

The collected germplasm were evaluated at RHRSS-Bhaderwah from 2008 onwards. Single plant selection was done to purify the mixtures of rajmash germplasm. Good yielding, maroon coloured bold seeded plants were identified and selected by adopting pureline selection. The results indicated that pure line BR 104 gave us the best results, This pure line was developed from Rajmash seeds collected from Village Lanchan, Bhaderwah, Dist. Doda (J&K). The seeds were maroon in colour and took 79 days for 50% flowering. There were 6 number of seeds/pod and the seed length was 1 cm, pod length was 9.1 cm and weight of 100 seeds was 32.2 g. The yield of BR 104 was 39.2 kg/kanal (7.84 q/h). Warming, Eug & W. Johannsen (1895) pureline theory states the same that from mixture of land races

purelines as new varieties can be developed. The second best pure line was BR 303 and it was developed from Rajmash seeds collected from Village Kansar, Bhaderwah, Dist. Doda (J&K). The seeds were medium red in colour and took 78 days for 50% flowering. There were 5.3 number of seeds/pod and the seed length was 1.1 cm, pod length was 8.2 cm and weight of 100 seeds was 30.7 g. The yield of BR 303 was 24.2 kg/kanal (4.84 q/h). The maize production was 80-100 kg/kanal approx. in these trials. The yield of BR 101 was 4.60 q/h. The yield of BR 307 was 4.07 q/h. The yield of BR 105 was 4.02 q/h. The yield of BR 301 was 3.89 q/h.

In future the studies can be made for biofortification, QTL/gene (Choudhary *et al.*, 2018; Steckling *et al.*, 2017) and for nutrients study (Grela *et al.*, 2017).

Table 3: Yield attributes of different genotypes of Rajmash (*Phaseolus vulgaris*) at harvest stages.

T. No.	Location	Yield (q/ha)	Stover Yield (q/ha)	Biological Yield (q/ha)	Harvest Index (%)
BR 101	Gwari, Bhaderwah	4.60	7.36	11.96	38.37
BR 104	Lanchan, Bhaderwah	7.83	11.59	19.42	40.31
BR 105	Chinchora, Bhaderwah	4.02	7.38	11.40	35.11
BR 301	Chatroo, Kishtwar	3.89	7.19	11.08	34.94
BR303	Kansar, Bhaderwah	4.84	7.49	12.33	39.25
BR 307	Chiralla, Doda	4.07	6.81	10.87	37.38
SE(m)		0.704	0.836	1.136	0.989
CD at 5%		2.246	2.67	3.625	3.158

CONCLUSION

It can be concluded that the collected Rajmash germplasm from different regions of erstwhile Doda district (Bhaderwah, Dakshin, Marwah, Chatroo, Jalgaon, Chinta, Kansar, Manthal, Chiralla, Nalthi, Gwari and Sartangal) were evaluated at RHRSS-Bhaderwah. On the basis of experimentations the pure line BR 104 gave us the best results.

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Conflict of Interest. The authors declare that there is no conflict of interest in the paper.

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