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EFFECT OF SOWING WINDOWS AND GENOTYPES ON YIELD AND ECONOMICS OF *KHARIF* RAJMAH

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ABSTRACT:

A field study was conducted at ZARS, Ganeshkhind, Pune, Maharashtra during kharif 2017 to 2019 to identify the yield potentials of rajmah varieties at different sowing windows. Rajmah varieties *viz.* Phule Rajmah, HPR-35 and Varun were evaluated for yields and economics under different sowing windows viz, MW-24 (11-17 June), MW-26 (25-1 July), MW-28 (9-15 July) and MW-30 (23-29 July). Treatments were evaluated in Factorial Randomized Block Design with three replications. The soil was medium black with pH 7.65, Organic Carbon 0.45 %, Available Nitrogen 220 kg/ha, P_2O_5 17.5 kg/ha and K_2O365 kg/ha. The crop was fertilized with 60:80:0 kg/ha N, P_2O_5 and K_2O.Significantly higher seed yield (16.50, 15.79, 15.70 and 15.87 q/ha, respectively) was recorded at harvest in sowing window S_1: MW-24 (11-17 June), while it was found at par with S_2: MW26 (25-1 July) during all the year of experiment and in pooled analysis. The genotype Phule Rajmah recorded significantly higher seed yield (14.64, 14.69 and 14.88 q/ha, respectively) during year 2018 and 2019 of experimentation and in pooled analysis while found at par with Varun in 2018 and 2019. The gross return (Rs.103155), Net returns (Rs. 57317) benefit cost ratio (2.25) was found highest in sowing window S_1: MW-24 (11-17 June) which was followed by S_2: MW26 (25-1 July) with gross returns (Rs.93275) Net returns (Rs. 47635) and benefit cost ratio (2.04). With respect to genotypes gross return (Rs.96720), Net returns (Rs. 51011) and benefit cost ratio (2.12) was found highest in Phule Rajmah which was followed by Varun (1.93B: C ratio).

Key words: - *Rajmah, Sowing windows, Varieties*.

INTRODUCTION:

India is the largest producer of pulses accounting for about 25 percent of the global share. Pulses are the second most important group of cropafter cereals in Jharkhand. During 2017-18 pulse was cultivated in 5.53 lakh ha. with annual production of 4,95,134 tonnes leading average productivity of 881 kg per ha. (Agriculture Directorate, Kharif Work shop Report, 2015-16) Pulses are least preferred by farmers because of high risk and also being less remunerative than cereals Consequently, the production of the pulses is sufficiently low it and doesn't meet the daily requirement of the growing population. The per capita per day availability of pulses has been reduced from 61g in 1951 to 32g in 2000 (DES, 2004) against the minimum requirement of 60g and optimum requirement of 104g per day per capita. Out of different strategies to increase pulses production, the introduction of promising pulse crops such as Rajmah (*Phaseolus vulgaris* L.) to non-traditional areas holds on of the options.

Rajmah or french bean (*Phaseolus vulgaris*) is also popularly known as Rajma, haricot bean, kindey bean, snap bean, navy bean, field bean, dry bean, pole bean etc. In India, it is grown mainly in Jammu and Kashmir, Himachal Pradesh, UP and some parts of Maharastra, Andhra Pradesh, Western and Eastern Ghats and North-East plains where winter are mild and frost free as a winter crop. The growth and development of any crop is primarily governed by the environmental conditions of the soil and

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climate. The prevailing weather conditions are important for success or failure of farming. Rajmah is one of the most important pulse crops in our country which is affected by weather. Influence of different time of sowing as well as temperature on phenology and yield of crop plants can be studied under field conditions through the accumulated heat unit's system (Bishnoi *et al.*, 1995).

Farmers can avoid some losses through simple changes of planting dates and Rajmah varietal types. Sowing time is the most critical factor for achieving higher productivity of Rajmah. Advanced or delayed sowing may cause substantial reduction in yield.

RESULT AND DISCUSSION:

The data on three years pooled results on effect of sowing windows and genotypes on *kharif* Rajmah are presented in Table. 1 to 4**.**

Growth parameters:

The data presented in Table. 1 revealed that the plant height of rajmah was significantly affected due to different sowing time during *kharif* 2017, 2018 and 2019. Significantly higher plant height (46.56, 39.56 and 40.11 cm, respectively) at harvest was recorded in S_1: MW-24 (11-17 June), while it was found at par with S_2: MW26 (25-1 July) and S_3: MW-28 (9-15 July) during 2017 2018. S_1 was found at par with S_2 only in 2019. While in pooled analysis significantly higher plant height (40.72 cm) at harvest was recorded in S_1: MW-24 (11-17 June), while it was found at par with S_2: MW26 (25-1 July). Differential response of varieties to plant height might be due to their genetic character and adaptability to growing environment. Prakash and Ram (2014) were of similar opinion with respect to this trait in French bean.

Genotype HPR- 35 recorded significantly higher plant height (44.3 and 40.58 cm, respectively) at harvest as compared to other genotypes during 2018 and 2019 and in pooled analysis. G_1 was found at par with G_2 in pooled analysis. While nonsignificant result was observed in 2017.Interaction effect with respect to plant height was found nonsignificant during all the three years of experimentation and in pooled analysis.

The number of branches were not affected significantly due to different sowing windows and genotypes and their interactions during all the three years of experimentation and pooled analysis.

Yield attributes and yield:

The data presented in Table. 2 revealed that number of pods plant^{-1} of rajmah was significantly affected due to different sowing time during *kharif* 2017, 2018 and 2019 and in pooled analysis. Significantly higher number of pods plant^{-1}(15.56, 15.22,14.78 and 14.70, respectively) at harvest was recorded in S_1: MW-24 (11-17 June), while it was found at par with S_2: MW26 (25-1 July) during 2018 and in pooled analysis.

Genotype Phule Rajmah recorded significantly higher number of pods plant^{-1} (15.58 and 15.47) at harvest as compared to other genotypes during 2018 and in pooled analysis. While nonsignificant result was observed in 2017 and 2018. The reports of Panday *et al* (2012) in French bean agree with the findings of present study. Interaction effect with respect to number of pods plant^{-1}was found nonsignificant during all the three years of experimentation and in pooled analysis.

The data presented in Table. 2 revealed that number of seeds pods^{-1} of rajmah was significantly affected due to different sowing time during kharif 2018 and

2019 and nonsignificant results were observed in pooled analysis. Significantly higher number of seeds pods^{-1} (4.56 and 4.63, respectively) at harvest was recorded in S_1: MW-24 (11-17 June), while it was found at par with S_2: MW26 (25-1 July) during both the year of experiment.

The different genotype recorded nonsignificant results in all the year of experimentation. Interaction effect with respect to number of seeds pod^{-1} was found nonsignificant during all the three years of experimentation and in pooled analysis.

The data presented in Table. 3 revealed that seed yield of rajmah was significantly affected due to different sowing time during kharif 2017, 2018 and 2019 and in pooled analysis. Significantly higher seed yield (16.50,15.79, 15.70 and 15.87, respectively) was recorded at harvest in sowing window S_1: MW-24 (11-17 June), while it was found at par with S_2: MW26 (25-1 July) during all the year of experiment and in pooled analysis.

The genotype Phule Rajmah recorded significantly higher seed yield (14.64, 14.69 and 14.88 q/ha, respectively) during year 2018 and 2019 of experimentation and in pooled analysis while found at par with Varun in 2018 and 2019. Interaction effect with respect to number of seeds pod^{-1} was found nonsignificant during all the three years of experimentation and in pooled analysis. Among the date of sowing, first fortnight of June recorded significantly higher harvest index value closely followed by second fortnight of June, which were on par. The lower harvest index was recorded with second fortnight of July. (Mallikarjun, 2004). The results are in conformity with those reported by Venkata *et al.* (2015).

The data presented in Table. 3 revealed that straw yield of rajmah was significantly affected due to different sowing time during *kharif*2017, 2018 and 2019 and in pooled analysis. Significantly higher straw yield (28.06, 26.69, 27.48 and 27.40 q/ha, respectively) was recorded at harvest in sowing window S_1: MW-24 (11-17 June) during all the year of experiment and in pooled analysis while it was found at par with S_2: MW26 (25-1 July) during 2017 and in pooled analysis.

The genotype Phule Rajmah recorded significantly higher straw yield (27.06, 24.75, 25.71 and 25.60 q/ha, respectively) during all the years of experimentation and in pooled analysis. While it was found at par with Varun in all three year except pooled mean. Interaction effect with respect to number of seeds pod^{-1} was found nonsignificant during all the three years of experimentation and in pooled analysis.

ECONOMICS:

Pooled results presented in Table 4 revealed that the gross return (Rs.103155), Net returns (Rs. 57317) benefit cost ratio (2.25) was found highest in sowing window S_1: MW-24 (11-17 June) which was followed by S_2: MW26 (25-1 July) gross returns (Rs.93275) Net returns (Rs. 47635) and benefit cost ratio (2.04).

With respect to genotypes gross return (Rs.96720), Net returns (Rs. 51011) and benefit cost ratio (2.12) was found highest in Phule Rajmah which was followed by Varun (1.93).

CONCLUSION:

Sowing of *kharif* Rajmah Cv. Phule Rajmah in MW-24 (11-17 June) recorded highest growth and yield attributes and seed yield and found at par results with sowing in S_2: MW26 (25-1 July). Sowing in S_1: MW-24 (11-17 June) found more remunerative followed by S_2: MW26 (25-1 July).

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Table 1: Effect of sowing windows and genotypes on Plant height, Number of branches of Rajmah

Treatments	Plant height (cm)				Number of branches plant-1			
	2017	2018	2019	Pooled Mean	2017	2018	2019	Pooled Mean
A) Sowing windows (S)								
S_1: MW-24 (11-17 June)	46.56	39.56	40.11	40.72	4.00	5.00	4.44	4.48
S_2: MW-26 (25 June-1 July)	43.89	39.44	39.00	39.81	3.78	4.78	4.11	4.22
S_3: MW-28 (9-15 July)	42.00	37.11	35.89	37.18	4.22	4.44	4.22	4.29
S_4:MW-30 (23-29 July)	37.44	33.33	34.44	34.38	4.00	4.22	3.67	3.96
SE±	1.79	1.02	0.95	0.45	0.27	0.26	0.24	0.15
C.D. at 5%	5.26	2.99	2.79	1.29	NS	NS	NS	NS
B) Genotypes								
G_1 : PhuleRajmah	44.42	37.75	38.50	40.22	4.00	4.75	4.00	4.25
G_2 : HPR-35	42.83	44.33	40.58	42.58	3.92	4.42	4.17	4.17
G_3 : Varun	40.17	30.00	33.00	34.39	4.08	4.67	4.17	4.31
SEm±	1.55	0.88	0.82	1.73	1.55	0.88	0.82	0.13
C.D. at 5%	NS	2.59	2.42	6.82	NS	NS	NS	NS
(A X B) Interaction								
SEm±	3.11	1.77	1.65	0.79	0.46	0.46	0.42	0.24
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS

Table 2 : Effect of sowing windows and genotypes on Number of pods plant-1 and Number of seeds pod -1 of Rajmah

Treatments	Number of pods plant-1				Number of seeds pod-1			
	2017	2018	2019	Pooled Mean	2017	2018	2019	Pooled Mean
A) Sowing windows (S)								
S_1: MW-24 (11-17 June)	15.56	15.22	14.78	15.19	4.83	4.56	4.63	4.46
S_2:MW-26 (25 June-1 July)	14.44	14.11	13.67	14.07	4.58	4.74	4.41	4.58
S_3: MW-28 (9-15 July)	14.67	13.56	13.00	13.74	4.67	4.44	4.32	4.47
S_4:MW-30 (23-29 July)	13.67	13.44	13.22	13.44	4.63	4.15	4.20	4.54
SE±	0.23	0.37	0.29	0.17	0.11	0.08	0.08	0.06
C.D. at 5%	0.69	1.09	0.86	0.49	NS	0.22	0.25	NS
B) Genotypes								
G_1 : PhuleRajmah	16.08	15.58	14.75	15.47	4.72	4.55	4.37	4.59

G_2 : HPR-35	14.25	14.00	13.42	13.88	4.68	4.38	4.46	4.47
G_3 : Varun	13.42	12.67	12.83	12.97	4.63	4.48	4.35	4.52
SEm±	1.55	0.88	0.82	0.15	1.55	0.88	0.82	0.003
C.D. at 5%	NS	2.59	NS	0.43	NS	NS	NS	NS
(A X B) Interaction								
SEm±	0.41	0.65	0.51	0.32	0.19	0.13	0.14	0.07
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS

Table 3: Effect of sowing windows and genotypes on Seed and straw yield of Rajmah

Treatments	Seed Yield (q/ha)				% yield reduction over S_1 and G_1	Straw yield (q/ha)			
	2017	**2018**	**2019**	**Pooled Mean**		**2017**	**2018**	**2019**	**Pooled Mean**
A) Sowing windows (S)									
S_1: MW-24 (11-17 June)	16.50	15.79	15.70	15.87	--	28.06	26.69	27.48	27.40
S_2:MW-26 (25 June-1 July)	15.22	14.60	14.72	14.35	9.57	25.87	24.19	24.65	24.89
S_3: MW-28 (9-15 July)	13.42	12.12	12.52	12.53	21.04	22.81	20.49	21.91	21.73
S_4:MW-30 (23-29 July)	11.10	10.57	8.59	9.67	39.06	18.86	17.87	15.03	15.92
SE±	0.58	0.41	0.34	0.50		0.99	0.69	0.59	0.74
C.D. at 5%	1.71	1.20	0.99	1.53		2.91	2.04	1.73	2.57
B) Genotypes									
G_1 : PhuleRajmah	15.92	14.64	14.69	14.88	--	27.06	24.75	25.71	25.60
G_2 : HPR-35	12.31	11.45	10.07	10.90	26.74	20.92	19.35	17.63	18.78
G_3 : Varun	13.95	13.51	13.41	13.53	9.07	23.72	22.83	23.46	23.27
SEm±	1.55	0.88	0.82	0.15		1.55	0.88	0.82	0.25
C.D. at 5%	NS	2.58	2.42	0.41		4.56	2.59	2.42	0.71
(A X B) Interaction									
SEm±	1.01	0.71	0.58	0.81		1.72	1.20	1.02	0.50
C.D. at 5%	NS	NS	NS	NS		NS	NS	3.00	NS

Table 4 : Economics (Pooled)

Treatments	Yield (q/ha)	Cost of cultivation (Rs.)	Gross monetary returns (Rs.)	Net monetary returns (Rs.)	B:C ratio
A) Sowing windows (S)					
S_1: MW-24 (11-17 June)	15.87	45837.1	103155	57317	2.25
S_2: MW-26 (25 June-1 July)	14.35	45639.5	93275	47635	2.04
S_3: MW-28 (9-15 July)	12.53	45402.9	81445	36042	1.79
S_4:MW-30 (23-29 July)	9.67	45031.1	62855	17823	1.40
B) Genotypes					
G_1 : PhuleRajma	14.88	45708.4	96720	51011	2.12
G_2 : HPR-35	10.90	45191	70850	25659	1.57
G_3 : Varun	13.53	45532	87945	42412	1.93

Selling rates:
2017: Rs. 6300/ qtl,
2018 :Rs. 6500/ qtl and
2019 :Rs. 6700/ qtl