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RESEARCH PAPER

Effect of planting dates and genotypes on root characteristics and yield of mungbean and urdbean during spring season

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Abstract : Two sets of experiments one each on mungbean and urdbean were undertaken during spring seasons of 2001-02 and 2002-03 at Govind Ballabh Pant University of Agriculture and Technology, Pantnagar to evaluate the root characteristics and yield of mungbean and urdbean under various planting dates and varieties. In each set of experiment, nine treatments consisted of three varieties each of mungbean (Narendra M-1, Pant M-2 and Pant M-5) and urdbean (Narendra U-1, Pant U-19 and Pant U-35) and three common planting dates (February 20, March 12 and April 1) were laid out separately in split-plot design keeping planting dates in the main plots and varieties in sub-plots with three replications. Results revealed that March 12 planting of mungbean and urdbean produced higher no. of grains/pod, pods/plant and improved source-sink relationship which led to generation of significantly higher grain yield than February 20 and April 1. While, the bolder grains were recorded under February 20 planting conditions. Grain yield / ha was significantly higher in Pant M-2 variety of mungbean and Narendra U-1 of urdbean, whereas Pant M-5 variety of mungbean and Pant U-19 of urdbean recorded the highest harvest index, respectively during the course of investigation. Planting of mungbean and urdbean beyond February had better root development. The no. of nodules / plant, dry weight of nodules, primary root length and dry weight of root/plant of mungbean and urdbean were recorded higher under late sowing of April-1. Narendra M-1 variety of mungbean and Narendra U-1 of urdbean recorded higher number of nodules/ plant, dry weight of nodules, primary root length and dry weight of root/plant during both the seasons. Despite the production of higher 1000-seed wt., Pant M-5 variety of mungbean and Pant U-19 of urdbean yielded lower.

Key Words : : Mungbean, Planting dates, Roots, Urdbean, Varieties, Yield

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INTRODUCTION

Mungbean and urdbean are the important pulse crops of summer season grown in India. The production of pulses in India was 13.1 million tonnes against the requirement of 20 million tonnes (Gupta *et al.*, 2004) indicating the shortfall which is to be minimized either by increasing the area under pulses or by increasing the productivity of pulses.

Most of the pulse crops used to be grown in rainfed, less fertile and discarded soils and there is less area under pulses in northern part of the country particularly where rice-wheat cropping sequence is dominating. One of the possible ways to increase the area under pulses in north India is to grow in non-conventional seasons like spring/summer or in intercropping system with the major crops of the region like sugarcane and potato. Short duration varieties of mungbean maturing in 60-70 days and of urdbean in 80-90 days are now available and can be grown in fields vacated by potato, mustard and sugarcane during spring season in irrigated agro-ecosystem.

Maximum yield potential of mungbean and urdbean can be exploited under appropriate combination of variety, environment / planting time and agronomic practices. The establishment and growth of crop plants depend much on sound root system. It is also true to postulate that plants with better developed root system are able to absorb nutrients efficiently from different layers of the soil profile and hence,

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affect the grain weight and vigour. Considering the above issues, the present investigation was laid out to find out the suitable planting dates and verities for higher productivity of mungbean and urdbean.

MATERIALS AND METHODS

Field experiments were conducted during spring seasons of 2001-02 and 2002-03 at Crop Research Centre of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar. The soil of the experimental site was silty clay-loam with neutral soil reaction (pH7.2) having high organic carbon (1.06%) and medium in available phosphorus (17.08 kg P/ha) and potassium (196.5 kg K/ha) contents .

Two sets of experiments one each on mungbean and urdbean were conducted for two consecutive years. In each set of experiment nine treatments consisted of three varieties each of mungbean (Narendra M-1, Pant M-2 and Pant M-5) and urdbean (Narendra U-1, Pant U-19 and Pant U-35) and three common planting dates (February 20, March 12 and April 1) were laid out separately in split plot design keeping planting dates in the main plots and varieties in sub-plots with three replications.

An uniform dose of 100 kg DAP (18% N and 46% P_2O_5) was applied as basal in both the experiments. Mungbean and urdbean crops were planted in lines 25 cm apart, using a seed rate of 40 and 30 kg/ha for urdbean and mungbean, respectively. Other agronomic practices were adopted as per recommendations for the crops.

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads:

Yield and yield attributes :

Grain yield/ha of mungbean and urdbean were significantly higher under March12 planting than February 20 and April 1 which were *at* par during both the years, except February 20 planting of urdbean during 2002-03 (Table 1 and 2). Significantly higher grain yield of mungbean and urdbean, under March 12 planting was probably due to favourable weather conditions. The lower grain yield of mungbean and urdbean in early planting (February 20) might be due to lower temperature at early stages of crop growth. Poor grain yield under late planting (April 1) might be due to high temperature coupled with hot and desiccating winds witnessed by both the crops. Similar responses of mungbean and urdbean to date of planting were also reported by Saini and Jaiswal (1991) and Dhanjal *et al*. (2000).

Among different varieties of mungbean Pant M-2 produced significantly higher grain yield as compared to remaining varieties. The lowest grain yield/ha was obtained from Narendra M-1 during both the years. The highest grain yield under Pant M-2 variety was mainly due to higher number of pods/plant and grain yield/plant. These findings are in close conformity with those of Patil and Deshmukh (1988) and Singh (1996).

Narendra U-1 variety of urdbean produced significantly higher grain yield/ha as compared to remaining varieties during 2001-02 however, it was at par with Pant U-19 during 2002-03. Higher gain yield under Narendra U-1 and Pant U-19 could be attributed to higher plant population at maturity, higher grain yield/plant and more number of pods/plant as compared to Pant U-35. Variation in yield under different varieties was also reported by Ram and Dixit (2000).

March 12 planting of mungbean and urdbean which was at par with February 20, recorded significantly higher harvest index, as compared to April 1 planting during both the years (Table 1and 2). Higher harvest index of mungbean and urdbean on March 12 was probably due to favourable source – sink relationship together with favourable weather conditions

Table 1 : Grain yield, harvest index and yield attributes in mungbean as influenced by planting dates and varieties

Treatments	Number of pods/ plant		Number of grains/ pod		1000 – grain weight (g)		Grain yield (kg/ha)		Harvest index (%)	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Planting date										
February 20	15.3	15.3	9.0	8.8	42.81	41.91	1163	1118	25.1	24.5
March 12	17.3	16.5	8.9	8.7	38.64	38.59	1452	1337	28.2	26.8
April 1	16.6	16.2	8.1	8.1	36.98	37.18	1063	1002	21.0	20.4
S.E. ±	0.3	0.2	0.2	0.1	1.09	0.86	62	60	1.5	1.6
C.D. (P=0.05)	1.3	0.9	0.7	0.5	4.25	3.35	175	174	4.1	4.5
Variety										
Narendra M-1	14.5	14.2	7.3	7.2	32.74	32.70	1047	972	19.1	18.1
Pant M-2	18.5	18.0	8.8	8.6	37.28	36.68	1370	1300	25.5	24.9
Pant M-5	16.3	15.9	9.9	9.7	48.41	48.30	1262	1185	29.7	28.7
S.E. ±	0.4	0.3	0.4	0.1	1.09	0.51	35	33	0.9	1.1
C.D. (P=0.05)	1.3	0.8	1.2	0.4	4.75	1.57	95	93	2.7	3.1

which caused better growth of plants. Similar observations were also reported by Kanungo (1980) and Sahu (1986). The reason of lowest harvest index of mungbean and urdbean in late planting (April 1) might be assigned to high temperature and continuous rains during growth and flowering stages that accelerated the growth process which caused excessive vegetative growth and poor flowering and pod setting that resulted into higher straw production and poor grain yield. Similar results were also recorded by Faroda *et al.* (1983).

Pant M-5 variety of mungbean and Pant U-19 variety of urdbean significantly recorded higher harvest index as compared to remaining varieties during both the years. Similar response of varieties of mungbean to harvest index was also advocated by Patil and Deshmukh (1988) and Singh (1996). Narendra M-1 and Narendra U-1 variety of mungbean and urdbean, respectively had poorest harvest index than other varieties. The possible reason for lowest harvest index could be the fact that these failed to translocate the photosynthates to the grains. The superiority of Pant U-19 over other varieties were also observed under AICPIP (1992).

Root traits :

Root growth of mungbean and urdbean in terms of number of nodules/plant, dry weight of nodules /plant, primary root length and dry weight of roots was significantly higher with delay in planting upto April 1 during both the years (Table 3 and 4).

April 1 planting, being at par with March 12, produced significantly lengthy roots of mungbean as compared to February 20 during both the years. However, the difference between February 20 and March 12 was not significant during both the seasons. The primary root length of urdbean increased significantly with delay in planting upto March 12 during 2001-02. However, the difference in root length between February

Table 2: Grain yield, harvest index and yield attributes in urdbean as influenced by planting dates and varieties

Treatments	Number of pods/ plant		Number of grains/ pod		1000 – grain weight (g)		Grain yield (kg/ha)		Harvest index (%)	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Planting date										
February 20	20.0	19.8	6.1	5.9	43.14	42.49	1142	1102	32.2	31.6
March 12	21.9	21.2	5.8	5.6	39.98	39.99	1453	1360	35.1	33.9
April 1	21.1	20.5	4.9	4.8	37.91	38.46	1030	980	25.5	24.5
S.E. ±	0.4	0.3	0.1	0.2	0.86	0.70	70	90	1.6	1.4
C.D. (P=0.05)	1.4	1.1	0.5	0.7	3.36	2.73	197	260	4.4	4.1
Variety										
Narendra M-1	23.0	22.4	6.1	6.0	38.01	37.51	1307	1250	28.4	27.4
Pant M-2	20.9	20.6	5.6	5.4	40.32	40.41	1210	1142	32.9	31.9
Pant M-5	19.0	18.6	5.2	5.0	42.70	43.02	1108	1050	31.6	30.7
S.E. ±	0.3	0.3	0.1	0.1	0.43	1.22	24	39	0.3	0.3
C.D. (P=0.05)	0.8	1.0	0.2	0.4	1.32	3.74	69	109	0.8	0.8

Table 3: Root characters of mungbean as influenced by planting dates and varieties

Treatments	Number of nodules / plant		Dry weight of nodules / plant (mg/plant)		Primary root length (cm)		Dry weight of root/plant (g)	
	2002	2003	2002	2003	2002	2003	2002	2003
Planting date								
February 20	11.3	11.8	14.87	15.04	10.0	9.6	0.15	0.13
March 12	13.3	13.5	17.70	18.93	10.8	10.2	0.19	0.18
April 1	16.2	16.6	20.51	21.35	11.4	10.9	0.23	0.22
S.E. ±	0.6	0.6	0.99	0.76	0.3	0.3	0.01	0.008
C.D. (P=0.05)	1.6	1.7	2.71	2.17	1.0	0.9	0.03	0.02
Variety								
Narendra M-1	14.7	15.1	22.00	22.79	11.4	10.9	0.21	0.19
Pant M-2	14.2	14.6	16.86	17.64	10.7	10.2	0.19	0.18
Pant M-5	11.8	12.2	14.22	14.89	10.1	9.6	0.17	0.16
S.E. ±	0.2	0.3	0.25	0.40	0.2	0.1	0.008	0.007
C.D. (P=0.05)	0.6	0.8	0.76	1.23	0.6	0.3	0.02	0.02

Table 4: Root characters of urdbean as influenced by planting dates and varieties

Treatments	Number of nodules / plant		Dry weight of nodules / plant (mg/plant)		Primary root length (cm)		Dry weight of root/plant (g)	
	2002	2003	2002	2003	2002	2003	2002	2003
Planting date								
February 20	8.4	8.9	12.95	13.07	9.7	9.3	0.16	0.14
March 12	10.0	10.6	15.55	16.66	10.6	9.9	0.45	0.44
April 1	12.8	13.2	18.33	18.80	10.9	10.4	0.49	0.48
S.E. ±	0.5	0.4	0.76	0.68	0.3	0.2	0.01	0.02
C.D. (P=0.05)	1.4	1.4	2.17	1.89	0.9	0.7	0.04	0.05
Variety								
Narendra U-1	10.8	11.5	16.41	17.05	11.3	10.7	0.40	0.39
Pant U-19	10.4	10.7	15.96	16.54	10.1	9.6	0.37	0.35
Pant U-35	10.1	10.4	14.47	14.94	9.9	9.3	0.34	0.33
S.E. ±	0.2	0.2	0.36	0.38	0.2	0.2	0.01	0.01
C.D. (P=0.05)	0.5	0.6	1.03	1.08	0.7	0.5	0.03	0.04

20 and March 12 could not reach to the level of significance during 2002-03.

Results of present study appended in Table 3 and 4 indicated that planting of mungbean and urdbean beyond February had significantly better root growth measured in terms of number of nodules/ plant, dry weight of nodules, primary root length and dry weight of roots. It appears that weather conditions (temperature, soil moisture, sun light etc.) prevailed during nodule formation and flowering stages under delayed planting of mungbean and urdbean were more conducive for root growth and nodulation under both the crops. Ram and Dixit (2000) also reported higher number of nodules/plant, nodule dry weight and root biomass/ plant under 30th March planting of mungbean.

Variety Narendra M-1 recorded significantly higher number of nodules / plant, nodules dry weight and longer primary roots as compared to Pant M-5 during both the years. However, Pant M-2 gave at par response to Narendra M-1 in terms of nodules /plant. Narendra M-1 recorded significantly more dry weight in roots during both the years. However, Pant M-2 gave at par response during 2002-03. A sound and well developed root system of Narendra M-1 is responsible for better plant growth which resulted into higher grain yield. These findings are in close conformity with those of Binh (1991) and Shukla and Dixit (1996).

Narendra U-1 variety of urdbean produced significantly more number of nodules/plant and dry weight of roots/plant during both the years of experimentation. However, it was found at par with Pant U-19 during 2001-02 with respect to higher number of nodules/plant. Pant U-19 gave significantly higher dry weight of roots / plant than Pant U-35 during 2001-02. Varieties Pant U-19 and Pant U-35 were unable to produce significant difference with respect to number of nodules / plant during both the seasons. But Pant U-35 produced significantly lower dry weight of nodules / plant. Better root proliferation and development recorded under Narendra U-1 might be responsible for better growth and development of crop, which resulted in higher grain yield in comparison to remaining varieties. Similar observations were also reported by Singh and Hiremath (1990), Sayao *et al.* (1991), Patel and Patel (1991).

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