



GROWTH AND YIELD BEHAVIOR OF URDBEAN GENOTYPES (*Vigna mungo* L.) UNDER DIFFERENT DATES OF SOWING AND EFFECT ON SOIL HEALTH

Mahavir Singh, N.S. Rana, G. S. Panwar, Adesh Singh and B.P. Dhyani

Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut (Uttar Pradesh) - 251 110
E-mail: mahavir_singh1234@rediffmail.com

ABSTRACT

Field experiment conducted during *kharif* seasons of 2004 and 2005 at Sardar Vallabh Bhai Patel University of Agriculture & Technology, Meerut (UP) to study growth and yield behavior of urdbean (*Vigna mungo* L.) genotypes to dates of sowing revealed that among the genotypes, Pant Urd 35 gave the maximum seed yield (1238 and 1214 kg/ha) followed by Pant Urd 19 (1112 and 1111 kg/ha) and NDU 1 (1009 and 1048 kg/ha) during 2004 and 2005, respectively. As far as sowing time is concerned 25 June was the best date resulted into a seed yield of 1231 and 1204 kg/ha during 2004 and 2005, respectively. A delay of 10 and 20 days in sowing reduced the seed yield by 8.4, 8.8 and 20.3, 21.0 % during 2004 and 2005, respectively. The highest uptake of nitrogen, phosphorus and potassium was also noticed in Pant Urd 35 and June 25 sown crop as compared to rest of the treatments. Nodule number and their dry weights, primary root length and total dry matter also followed the similar trend as the NPK uptake. The crop took highest days to attend flowering, podding and maturity when sown on June 25, however, among genotypes Pant Urd 35 took the largest duration to affecting maturity and NDU 1 the shortest during both the season.

Key Words : Urdbean, genotype, dates of sowing, NPK uptake.

Urdbean (*Vigna mungo* L.) contains about 25 per cent protein of high digestibility and quality. India is the major producer and consumer of urdbean in the world, occupying about 3.1 m ha area with the annual production of 1.1 mt. Being a leguminous crop, urdbean fixes about 30-40 kg N/ha. Development of short duration determinate growth habit and photo-insensitive varieties has further offered excellent opportunity of urdbean cultivation during *kharif* season. The potential of genotypes can be reduced by providing suitable agro

environmental conditions for their growth and development. Planting time is the one of the most important non-monetary inputs affecting the growth and yield of a crop due to change in the environmental conditions during growth period. Urdbean, being a pulse crop is comparatively more sensitive to weather changes particularly soil moisture regimes, temperature and photoperiod. Early sowing may subject flowering and pod development stage to rains led to poor grain filling and even sprouting of grains in pods whereas, delayed

sowing may expose the crop to low temperature conditions again influencing the flower initiation and pod development. The performance of crop cultivars is always variable depending upon the climatic conditions prevailing during the various growth phases. The present study was therefore conducted to evaluate three urdbean cultivars under different planting dates.

MATERIALS AND METHODS

A field study was conducted for 2 years (2004 to 2005) at SVPUA & T, Modipuram, Meerut (29°4' N and 77°46' E, 237 m above mean sea level). The climate of Modipuram is semi-arid sub-tropical, characterized by very hot summers and cold winters. The average annual rainfall is 863 mm, 75 to 80 % of which is received through the south west monsoon during July to September. The experimental soil was sandy loam (64.1% sand, 18.3 % silt and 17.6 % clay) in texture (Typic Ustochrept) with adequate internal drainage, low in organic matter (0.26% organic carbon) and available N (166.9 kg N/ha), medium in available P (27.1 kg P₂O₅ /ha) and available K (200.0 kg K₂O/ha) and slightly alkaline in soil reaction (pH 7.4) with an electrical conductivity of 0.024 dS/m. There were 9 treatment combinations having 3 genotypes, viz. Pant Urd 19, Pant Urd 35 and NDU 1 and 3 dates of sowing, viz. June 25, July 15 and August 4 laid out in factorial

randomized block design with 3 replications. The nutrients were applied @ 20 kg N, 50 kg P₂O₅ and 25 kg K₂O/ha through DAP and MOP, just before the sowing of crop, treatment wise in the rows with the help of a sprayer below the seed at 5 cm depth. The gross plot size was 5.0 m x 4.5 m and the net plot size was 4.0 m x 2.7 m. The crop was sown in rows, 45 cm apart manually and the plant to plant spacing maintained at a distance of 10 cm by thinning done at 15 days after sowing. Other agronomic management practices were followed as per the standard recommendations. The concentrations of various nutrients like N, P and K in seeds and stover of the plants were estimated by methods adopted as Prasad *et al.* (2006). The nutrient uptake was determined by multiplying the concentrations with their respective dry matter yield. The rainfall received during the crop period was 71.0 mm and 111.5 mm during 2004 and 2005, respectively.

RESULTS AND DISCUSSION

Growth:

All the growth parameters varied significantly with planting dates and genotype during both the years except emergence count which did not show any variation due to both planting date as well as genotypes although, the plant population at harvest decreased significantly with each delaying in the planting date from June 25 to August

Table 1 : Plant population and growth parameters as influenced by sowing time and genotypes

Treatments	Emergence count (%)		Plant population at harvest (000plant/ha)		Plant height (cm)		Number of (trifoliolate) leaves per plant		Number of branches per plant		Dry matter accumulation (g) per plant	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Sowing time												
June 25	482	491	438	444	90.6	92.1	16.2	17.2	6.4	6.4	20.9	21.0
July 15	482	486	434	440	92.9	93.4	15.1	15.6	6.2	6.2	20.7	20.8
August 4	482	484	434	435	87.4	87.9	12.3	12.8	5.8	5.8	20.4	20.5
SEm±	4.14	4.62	3.96	4.7	0.8	0.9	0.1	0.1	0.1	0.09	0.3	0.3
C.D.(P=0.05)	NS	NS	NS	NS	2.6	2.9	0.3	0.3	0.3	0.2	NS	NS
Genotypes												
Pant U-19	475	479	428	435	90.5	91.1	14.6	17.6	6.2	6.2	20.2	20.4
Pant U-35	503	510	458	463	93.0	94.2	14.8	17.8	6.3	6.3	22.1	22.1
NDU-1	467	471	420	427	87.4	88.1	14.1	17.1	5.9	5.9	19.8	19.8
SEm±	4.14	4.62	3.96	4.70	0.8	0.9	0.1	0.1	0.1	0.09	0.3	0.3
C.D.(P=0.5)	12.42	13.86	11.06	14.12	2.6	2.9	0.3	0.3	NS	0.3	1.0	0.9

4 during both the years (Table 1). Among genotypes Pant Urd 35 had maximum plants 503000 and 510000/ha at harvest and statistically superior over Pant Urd 19 (475000 and 479000) and NDU 1 (467000 and 471000) during 2004 and 2005, respectively. Though the differences between Pant Urd 19 and NDU 1 were also significant. Crop sown on June 25 resulted into significantly taller (92.9 and 93.4 cm) plants, highest number of trifoliates (16.2 and 17.2), branches/plant (6.4 and 6.4) and total dry matter at harvest (20.9 and 21.0 g/plant) as compared to July 15 and August 4 sown crop during 2004 and 2005, respectively. Among the genotypes Pant Urd 35 recorded the highest values of growth parameters which were significantly superior over Pant Urd 19 and NDU 1. The lowest values were obtained from NDU 1 in respect of all the growth parameters. The highest dry matter accumulation per plant was observed in Pant Urd 35, which was significantly higher than Pant Urd 19 and NDU 1 which were at par during both the years. The highest dry matter per plant in Pant Urd 35 was mainly due to the better plant stand at harvest and the more number of trifoliolate, branches as well as the plant height.

Developmental studies :

The significant variation was observed for days taken to flowering, podding and maturity due to variation

in sowing time and genotypes during both the years (Table 2). The crop took maximum days for flowering and podding when sown on June 25. The delaying in sowing after June 25 will reduce the number of days taken to flowering and podding and increase maturity days though the crop sown on July 15 and August 4 took more or less similar days for flowering and podding during both the years except to podding during 2005. Pant Urd 35 took the maximum duration (86.6 and 87.4 days) and NDU 1 the shortest (83.5 and 83.9 days) to attain maturity. Although, all the genotypes varied significantly among each other in respect of days taken to flowering, podding and maturity during both the years.

Root Study

The data presented in Table 3 revealed that the dry weight of nodule and primary root length during 2004 varied significantly with sowing dates while number of nodules/plant, dry weight of nodules/plant and primary root length during was remained unaffected a significant affect of different genotypes on numbers of nodules/plant and dry weight of nodules was found during both the years while primary root length and dry weight of root/plant during 2004 remained unaffected. The highest number and dry weight of nodules, length of roots were recorded when crop was sown on June 25, August 4 sown crop resulted in significantly lower

Table 2 : Number of days taken to flowering, podding and maturity as influenced by sowing time and genotypes

Treatments	Number of days taken to Flowering		Number of days taken to Podding		Number of days taken to Maturity	
	2004	2005	2004	2005	2004	2005
Sowing time						
June 25	50.7	51.2	53.0	53.1	84.6	84.7
July 15	50.5	48.7	53.1	53.0	84.7	85.1
August 4	50.1	48.3	51.0	51.6	85.9	86.1
SEm±	0.4	0.3	0.4	0.4	0.6	0.6
C.D.(P=0.05)	NS	1.1	NS	1.3	NS	NS
Genotypes						
Pant U-19	50.6	49.9	52.1	52.2	85.1	84.7
Pant U-35	52.1	50.5	53.2	53.6	86.6	87.4
NDU-1	48.6	47.9	51.8	51.9	83.5	83.9
SEm±	0.4	0.3	0.4	0.4	0.6	0.6
C.D.(P=0.5)	1.4	1.1	1.3	1.3	1.8	1.8

Table 3 : Nodules (Number and dry weight) root length and root dry weight as influenced by sowing time and genotypes

Treatments	Number of nodules/plant		Dry weight of nodules(mg)		Primary root length(cm)		Dry weight of root/plant (g)	
	2004	2005	2004	2005	2004	2005	2004	2005
Sowing time								
June 25	20.9	21.5	17.0	15.1	14.7	14.6	0.48	0.49
July 15	20.4	20.9	14.3	14.3	14.4	14.2	0.58	0.50
August 4	20.6	21.2	13.9	14.0	13.6	13.8	0.56	0.51
SEm±	0.4	0.5	0.2	0.2	0.2	0.3	0.01	0.01
C.D.(P=0.05)	NS	NS	0.8	0.7	0.7	NS	NS	NS
Genotypes								
Pant U-19	20.9	21.4	14.5	14.7	14.2	14.3	0.55	0.49
Pant U-35	22.0	22.5	15.6	15.6	14.6	14.6	0.60	0.53
NDU-1	19.0	19.6	13.1	13.1	13.9	13.8	0.56	0.47
SEm±	0.4	0.5	0.2	0.2	0.2	0.3	0.01	0.01
C.D.(P=0.05)	1.2	1.5	0.8	0.7	NS	NS	NS	0.04

number and dry weight of nodules during both the years respectively than the 25 June sowing dates and primary root length than rest of the sowing dates during 2004. Among genotype Pant Urd 35 resulted into significantly higher number of nodules and their dry weight during both the years primary root length did not varied significantly under different genotypes during both the years while dry weight of root/plant varied significantly during 2005

Yield and yield attributes :

Sowing dates and genotypes markedly affected the yield and yield attributes during both the years (Table 4). Grain yield per plant and per ha recorded with June 25 sowing dates significantly higher than 4 August sowing and significantly at par with 15 July. The reduction in grain and straw yield per ha after 25 June was to the tune of 5.0, 22.0, 3.0, 17.0, and 3.0, 7.0, 1.0, 8.0 % during 2004 and 2005 respectively. The highest grain yield (1231 and 1204 kg/ha) in June 25 sown crop

Table 4 Yield attributes and yield of urdbean as influenced by sowing time and genotypes

Treatments	Number of pods/plant		Number of grains/pod		1000-grain wt. (g)		Grain yield /plant(g)		Grain yield(kg/ha)		Straw yield (kg/ha)	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Sowing time												
June 25	21.3	22.4	7.1	7.4	40.5	41.3	5.8	6.2	1231	1204	2565	2500
July 15	20.2	20.8	6.1	6.2	37.6	39.0	5.2	5.3	1169	1170	2498	2524
August 4	18.5	21.5	5.6	5.7	35.7	37.3	5.1	5.2	960	999	2384	2294
SEm±	0.6	0.6	0.2	0.2	0.8	0.7	0.3	0.2	34	37	95	76
C.D.(P=0.05)	2.0	NS	0.7	0.8	2.6	2.1	NS	0.6	103	112	NS	NS
Genotypes												
Pant U-19	20.1	21.6	6.2	6.5	37.6	39.0	5.2	5.4	1112	1111	2465	2471
Pant U-35	21.0	23.4	6.8	6.8	39.6	40.8	6.3	6.4	1238	1214	2775	2634
NDU-1	19.0	19.7	5.7	6.0	36.6	37.7	4.6	4.9	1009	1048	2204	2213
SEm±	0.6	0.6	0.2	0.2	0.8	0.7	0.3	0.2	34	37	95	76
C.D.(P=0.05)	NS	1.8	0.7	NS	NS	2.1	0.9	0.6	103	112	201	228

Table 5 : Nutrient uptake (by grains, straw and total) in urdbean as influenced by sowing time and genotypes

Treatment	Nutrient uptake (kg/ha)																	
	Nitrogen						Phosphorus						Potassium					
	Grains		Straw		Total		Grains		Straw		Total		Grains		Straw		Total	
	200	205	200	205	200	205	200	205	200	205	200	205	200	205	200	205	200	205
	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5
Sowing time																		
June 25	39.6	39.9	35.8	34.8	75.4	74.8	91	8.9	4.9	4.8	14.0	13.7	5.4	5.3	27.8	27.2	33.3	32.5
July 15	33.4	39.7	33.5	33.5	67.0	73.2	84	8.4	4.7	4.8	13.2	13.2	4.8	4.8	26.8	27.2	31.7	32.0
August 4	27.8	29.3	30.9	29.6	58.8	58.9	69	7.2	4.5	4.3	11.4	11.5	3.7	3.8	25.5	24.7	29.2	28.5
SEM±	0.9	1.2	1.3	1.6	1.4	2.5	0.2	0.2	0.1	0.1	0.3	0.3	0.1	0.1	0.7	0.7	0.8	0.8
C.D.(P=0.05)	2.9	3.7	NS	NS	6.1	11.3	0.7	0.7	NS	NS	1.0	1.1	0.5	0.5	NS	NS	2.5	3.4
Genotypes																		
Pant U-19	33.1	33.8	33.5	33.2	66.5	67.8	81	8.1	4.7	4.7	12.8	12.8	4.9	4.8	26.5	26.7	31.4	31.5
Pant U-35	38.3	38.0	37.8	36.3	76.2	75.9	91	8.9	5.3	5.0	14.4	14.0	5.1	5.0	30.0	28.5	35.1	33.6
NDU-1	29.5	31.2	28.9	28.7	58.4	59.9	72	7.4	4.2	4.2	11.4	11.7	3.9	4.2	23.7	23.8	27.6	28.0
SEM±	0.9	1.2	1.3	1.6	1.4	3.5	0.2	0.2	0.1	0.1	0.3	0.3	0.1	0.1	0.7	0.7	0.8	0.8
C.D.(P=0.05)	2.9	3.7	4.0	4.8	6.1	11.0	0.7	0.7	0.3	0.4	1.0	1.1	0.5	0.5	2.2	2.3	2.5	3.4

Table 6 : Nutrient content in grains and straw of urdbean as influenced by sowing time and genotypes

Treatments	Nutrient content (%)																							
	Nitrogen(%)				Phosphorus(%)				Potassium(%)				Nitrogen(%)				Phosphorus(%)				Potassium(%)			
	Grains		Straw		Grains		Straw		Grains		Straw		Grains		Straw		Grains		Straw		Grains		Straw	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005		
Sowing time																								
25-June	3.74	3.83	0.861	0.861	0.862	0.862	0.513	0.518	0.518	1.62	1.62	1.62	0.224	0.224	0.223	0.223	1.064	1.064	1.266	1.266	1.253	1.253		
15-July	3.32	3.36	0.838	0.838	0.838	0.838	0.484	0.485	0.485	1.55	1.53	1.53	0.222	0.222	0.223	0.223	1.245	1.245	1.252	1.252	1.254	1.254		
4-August	3.35	3.41	0.836	0.836	0.839	0.839	0.45	0.448	0.448	1.51	1.5	1.5	0.223	0.223	0.222	0.222	1.247	1.247	1.252	1.252	1.254	1.254		
SEM±	0.03	0.03	0.013	0.013	0.006	0.006	0.006	0.007	0.007	0.01	0.01	0.01	0.01	0.01	0.007	0.007	0.03	0.03	0.04	0.04	0.04	0.04		
C.D.(P=0.05)	0.11	0.10	0.038	0.038	0.02	0.02	0.02	0.021	0.021	0.04	0.05	0.05	NS	NS	0.21	0.21	0.11	0.11	0.12	0.12	0.12	0.12		
Genotypes																								
Pant U-19	3.45	3.53	0.85	0.85	0.851	0.851	0.514	0.503	0.503	1.57	1.56	1.56	0.224	0.224	0.224	0.224	1.252	1.252	1.257	1.257	1.26	1.26		
Pant U-35	3.58	3.63	0.856	0.856	0.857	0.857	0.481	0.484	0.484	1.59	1.6	1.6	0.224	0.224	0.224	0.224	1.257	1.257	1.254	1.254	1.254	1.254		
NDU-1	3.38	3.44	0.828	0.828	0.831	0.831	0.453	0.465	0.465	1.52	1.49	1.49	0.221	0.221	0.221	0.221	1.25	1.25	1.254	1.254	1.254	1.254		
SEM±	0.03	0.03	0.013	0.013	0.006	0.006	0.006	0.007	0.007	0.01	0.01	0.01	0.01	0.01	0.007	0.007	0.03	0.03	0.04	0.04	0.04	0.04		
C.D.(P=0.05)	0.11	0.10	0.038	0.038	0.02	0.02	0.02	0.021	0.021	0.04	0.05	0.05	0.04	0.04	0.021	0.021	0.11	0.11	0.12	0.12	0.12	0.12		

was mainly due to the more number of pods/plant, number of grains/pod and 1000-grain weight during both the years. The reduction in the yield due to delay in sowing might be attributed to less flowering and pod setting on account of unfavorable temperatures accompanied by rains coinciding with flowering and pod setting stage of the late sown crop. Chaudhary *et al.* 1994 have also represented marked reduction in grain yield of urdbean due to delay in sowing beyond June. The crop sown on June 25 produced the maximum pods/plant, grains/pod and 1000 grain weight closely followed by that sown on July 15. Both the sowing dates were significantly better than August 4 sowing date during both the years. The higher number of pods/plant, grains/pod and 1000 grain weight in June 25 and July 15 sown crop might be due to favorable environment at the time of fruiting and maturity. Similar results have also been represented by Ali *et al.* 1981.

Among varieties, Pant Urd 35 gave the highest grain as well as straw yield, closely followed by Pant Urd 19 and statistically superior than NDU 1 during both the year. In respect of grain yield Pant Urd 35 and Pant Urd 19 out yielded over NDU 1 by 116 and 103, 229 and 166 kg/ha during 2004 and 2005 respectively. The highest yield of Pant Urd 35 was mainly attributed to the more number of pods/plant, grains/pod and 1000 grain weight in compare in to other varieties, being minimum values in NDU 1, indicating that the Pant Urd 35 is more suitable as *kharif* crop in partitioning the net assimilates towards reproductive plant parts In both the years.

NPK uptake :

The data presented in Table 5 clearly indicates that the uptake of N,P and K by grains, and total biomass of urdbean was significantly higher under June 25 sowing as compared to remaining sowing dates during 2004 while no such effect was found during 2005. Removal of N,P and K by straw did not varied significantly under different dates of sowing during both the years. The differences between July 15 and August 4 sown crop in respect of N,P and K removal by urdbean grain and total produce were also significant

during both the years. Since uptake is a product of nutrient concentration (Table 6) and yield hence, higher yield (grain and straw) under June 25 sown crop might have increased the total N,P and K uptake this finding was similar to that of Singh and Singh (2000). With exception of straw P content 2004, the N,P and K content in grains and straw varied significantly (Table 6) with dates of sowing, being highest in June 25 sown crop during both the years. The N,P and K content in straw did not differ significantly 15th July and 4th August sown crop. Among genotypes, Pant Urd 35 recorded higher N, P and K uptake (grains, straw and total) as compared to other varieties during both the years. Higher NPK uptake by Pant Urd 35 in grain and total produce might be due to more grain yield and better diversion of NPK towards economic sink i.e. grain, the concentration of N,P and K in grains as well as straw were also more (Table 6) in Pant Urd 35 as compared to rest of the genotypes which also directly correlated with the total uptake of nutrients. Variable response of urdbean varieties to NPK uptake was also reported by Kumar *et al.* (2007).

CONCLUSION

It can be concluded from the study that urdbean genotype Pant Urd 35 sown on June 25 performed better under semi arid conditions of North India.

REFERENCES

- Ahmad B and Bajwa M S (1974)** A study of growing periods in mash (*Phaseolus mungo L.*). *Pakistan Journal of Agricultural Sciences* **11 (1/2):** 55.59.
- AICRP (1999).** All India Co-ordinate projects on Improvement of MULLARP. *Annual Report (Kharif)*, p.p182
- Ali M, Rawat C R and Dhar S N (1981).** Productivity of kharif crops as influenced by planting time under dry land condition. *Indian Journal Agronomy* **26(1):** 71-76.
- Aphiphan P, Harisadee P and Sawai P (1985)** Improvement of yield and quality of high protein grain legumes, agronomic and physiological aspects. Research project, Kasatsart univ., Bangkok, p.p 13-14

Binh H N (1991). Response of mungbean genotypes to plant density. M. Sc. (Ag.) thesis, submitted in G.B.P.U.A. &T., Pantnagar, p.p 107

Borah A R and Borthakur M P (1984). Response of rain-fed mung to different dates of sowing and seed inoculation with Rhizobium culture. *Journal of Research Assam agricultural University* **5(1):** 97-98.

Chaudhary D C, Singh R P and Singh N P (1988). Response of blackgram cultivars to date of planting. *Indian Journal Agronomy* **33(4):** 442-445.

Chaudhary D C, Singh R P and Singh N P (1994). Growth behavior of urdbean varieties in relation to planting dates. *Legume Research* **17(2):** 124-126.

Kumar A, Singh N P, Singh V K, Rana N S and Singh A (2007). Effect of planting dates on yield and nutrients uptake by mungbean and urdbean varieties during spring season. *Journal of Farming System Research and Development* **13 (2):** 280-283.

Prasad R, Shivay Y S, Kumar D and Sharma S N (2006). Learning by doing exercises in soil fertility-A particle manual of soil fertility. Division of Agronomy, IARI, New Delhi.

Singh D K and Singh V K (2000). Growth and nitrogen uptake pattern of promising urdbean genotypes under different sowing dates and plant densities during rainy season. *Annals of Agricultural research* **21(3):** 456-458.
