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Studies on effect of nitrogen on nodulation and growth parameters of black gram (*Vigna mungo* L.)

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Abstract
Present investigation was carried out during kharif season at the farm of Samarth Agriculture College Deulgaon Raja Dist. Buldana. Among growth parameter results indicated significant increase in plant height, where the varieties x N interaction were significant at 50 DAS and 65 DAS. Urd bean cultivars showed significant varietal differences in respect of number of leaves plant^{-1} at 20, 35 and 65 DAS. Varietal differences were not significant at 50 DAS. The cultivar AKU-19 required significantly less number of days (32.10) days for flowering. The cultivar TAU-1 and No-55 varied significantly. In nodulation at 35 DAS, cultivar No- 55 showed significantly higher nodules (11.20) plant^{-1} then TAU-1 (10.24) and AKU-19 (9.63).

Keywords: Nitrogen, nodulation, growth parameters, *Vigna mungo* L.

Introduction
Among pulses, Black gram (*Vigna mungo* L.) is important leguminous rain-fed crop which helps in maintaining soil fertility by fixing atmospheric nitrogen. The nitrogen so fixed is at par with 20 kg N ha^{-1}. Black gram is grown in India, Bangladesh, Pakistan, Myanmar and Ceylon. It is grown all over the country in kharif and summer season. This crop is grown on 31.47 lakh hectare area with total production of 13.32 lakh tonnes (*Anonymous*, 1997). Nitrogen is an essential micronutrient and plays great role in maintenance of longevity of root nodules and greenness of plant by inducing growth of vegetative parts and symbiotic phenomenon in legumes. It is also use as nutritive fodder for milk animals. It's foliage can be used as green manure or can be converted into hay and silage. Taking into consideration the importance of black gram the present investigation was taken to study the effect of different nitrogen levels on nodulation and growth parameters of black gram.

Materials and Method
Present investigation was carried out at the farm of Samarth Agriculture College Deulgaon Raja Dist. Buldana. during kharif season. For the experiment, Rhizobium treated seeds of black gram variety TAU-1, AKU-19 and NO-55 were obtained from Pulses Research Unit, Dr. P.D.K.V. Akola. 25 Kg N ha^{-1}.was applied at the time of sowing in the form of Urea, 50 kg P_2O_5 ha^{-1}. in the form of single super phosphate was applied as common basal dose to whole experimental area. Remaining doses of 'N' were applied at 35 DAS. For recording observations on plant height, number of leaves five plants from each plot in each replication were randomly selected and labelled. Observations on above parameters were recorded on the selabeled plants. The plants were uprooted for taking the observation on nodules plant^{-1}. The observations on growth were recorded at an interval of 15 days. Plant height was measured from the growing leaves up to the tip of main axis in centimetres. Height is expressed as mean height/ plant. Number of leaves /plant was recorded by counting fully expanded leaves at 20, 35, 50 and 65 DAS). Data is expressed as mean no. of leaves plant^{-1}. To take the data on nodules, the plants were watered to Loose the soil around their roots. These plants were uprooted carefully causing least damage to the root system. The plants were kept in WATER FOR 10-15 minutes to remove the soil particles from roots ant root nodules. After washing, number of nodules was counted. Observations on nodule numbers were recorded at 15 days intervals from 20 to 65 DAS.

Results and Discussion

Plant height is an important character which provides space for bearing leaves, branches, flowers and pods. The data presented in table-1 revealed that the cultivars showed significant varietal differences in respect of plant height at all stages of observations. At 20 DAS, varieties varied significantly Cultivar NO- 55 recorded maximum height (22) followed by TAU-1 and AKU-19 (9.77 and 7.31) in order. N_1, N_2 and N_3 recorded significantly higher plant height over N_1, N_2 and N_3 were at par. At 35 DAS, N_1, N_2 and N_3 recorded significantly higher plant height than control (N_0) Plant height at N_1, N_2 and N_3 were at par. At 50 DAS, N_2 showed significantly higher plant height over N_0, N_1 and N_3. respectively. N_1 and N_3 had significantly higher plant height than control. N_1 and N_3 were at par. Interaction effects was significant. At all nitrogen levels NO-55 exhibited significantly higher plant height followed by TAU-1 and AKU-19 in order. All cultivars showed significantly higher plant height at N_2 (50 Kg N ha^{-1}). At 65 DAS, N_1, N_2 and N_3 recorded significantly higher plant height than N_0. Plant height at N_2 and N_3 was at par and was significantly superior over N_1. These findings confirms the results of Singh and Saxena (1977), who observed that the Urd- bean crop might not be able to attain maximum growth (without fertilizers) if they were made to grow on symbiotically fixed en nitrogen alone.

Photosynthetic capacity of the plants depends on number and size of leaves. The data from table-2 indicated that, Urd- bean cultivars showed significant varietal differences in respect of number of leaves/plant at 20, 35 and 65 DAS. Varietal differences were not significant at 50 DAS. At all stages of observations, AKU-19 recorded significantly least number of leaves/plant. Cultivar NO-55 had maximum number of leaves $plant^{-1}$ and was at par with TAU-1. At 65 DAS, NO- 55 noted higher leaf number (13.91) per plant than TAU-1 (13.02). Nitrogen application showed significant effect on number of leaves $plant^{-1}$ at 20, 50 and 65 DAS. N_1, N_2, and N_3 exhibited significantly higher number of leaves $plant^{-1}$ over N_0 at 20 and 35 DAS, N_1, N_2, and N_3 were at par, whereas at 50 and 65 DAS, N_2 showed significantly more leaves $plant^{-1}$ over N_1 and N_3, respectively. N_1 and N_3 were at par. Interaction effects were not significant except 50 DAS.

The data from Table-3 indicated the varietal differences. The cultivar AKU-19 required significantly less no. of days (32.10) for flowering. The cultivar NO-55 required (36.70) days for flowering, while TAU-1 flowered at (35.50) days. N_0 (control) required significantly less days for flowering (33.10) than N_1 (34.40) days, N_2 (36.80) and N_3 (35.00) levels of nitrogen. Plants grown at N_1 and N_3 levels of nitrogen required more or less same number of days for flowering 50 kg nitrogen application significantly delayed flowering over rest of nitrogen levels. The variety x N interaction was not significant. The cultivars maintained same trend to that of 50 per cent flowering for days to field maturity. NO-55 required maximum days for maturity followed by TAU-1 and AKU-19 in order. Nitrogen levels delayed the flowering as compared to control (N_0). Significant delay in maturity was observed at N_2 over rest of nitrogen levels. Interaction effect was not significant.

The results depicted in table 4 showed that at 35 DAS, cultivar NO-55 showed higher nodules (11.20) $plant^{-1}$ than TAU-1 (10.24) and AKU-19 (9.63). Root nodules $plant^{-1}$ of cultivar TAU-1 and AKU-19 were at par. Varietal differences were not significant at 50 DAS. At 50 DAS, AKU-19 recorded higher number of root nodules $plant^{-1}$ (10.98). Mean nodule number $plant^{-1}$ in cultivar TAU-1 and NO-55 were at par. At 35 DAS, N_1, N_2, and N_3 recorded higher nodules plant-1 over control. Varieties x N interaction were not significant. At 50 DAS, N_1, N_2, and N_3 showed higher nodules/plant over control. Similar trend was observed at 65 DAS. Interaction effect at 50 and 65 DAS were not significant. Similar results were also reported by Mathur *et al.* (1988), Rajeshwari (1991) [6, 8]. Reddy *et al.* (1978) also observed that application of nitrogen as a basal dose along with rhizobium inoculation in black-gram significantly increased number of nodules per plant over control.

Table 1: Effect of nitrogen on plant height/plant (cm) of urd-bean cultivars

Treatments	20 DAS					35 DAS					50 DAS					65 DAS				
	N0	N1	N2	N3	Mean	N0	N1	N2	N3	Mean	N0	N1	N2	N3	Mean	N0	N1	N2	N3	Mean
TAU-I	9.17	9.13	10.96	9.83	9.77	18.83	19.96	20.80	19.23	19.70	31.66	33.56	35.22	34.16	33.67	52.26	54.94	57.20	54.94	54.83
AKU-19	6.34	7.04	8.77	7.10	7.31	12.26	12.82	14.21	13.10	13.09	26.12	29.35	29.35	27.41	27.53	49.13	51.20	51.20	52.16	50.92
NO-55	18.34	22.26	24.17	23.24	22.00	34.18	36.17	36.31	38.16	36.20	54.16	61.27	61.27	57.30	57.22	51.72	70.20	73.78	76.24	67.98
Mean	11.28	12.81	14.63	13.39		21.75	22.98	23.77	23.77		31.21	41.98	41.98	39.62		51.03	58.78	60.72	61.11	
	Varieties	Nitrogen	V x N			Varieties	Nitrogen	V x N			Varieties	Nitrogen	V x N			Varieties	Nitrogen	V x N		
F- test	Sig	Sig	N.S.			Sig	Sig	N.S.			Sig	Sig	N.S.			Sig	Sig	N.S.		
S. E. (m)+	0.474	0.548	0.949			0.331	0.382	0.663			0.240	0.277	0.481			0.626	0.723	1.253		
C.D. at (5%)	1.393	1.608	-			0.972	1.123	-			0.705	0.815	1.141			1.838	2.122	3.676		

Table 2: Effect of nitrogen on number of leaves /plant of urd-bean cultivars

Treatments	20 DAS					35 DAS					50 DAS					65 DAS				
	N0	N1	N2	N3	Mean	N0	N1	N2	N3	Mean	N0	N1	N2	N3	Mean	N0	N1	N2	N3	Mean
TAU-I	2.73	4.93	4.70	4.74	4.27	7.10	8.12	8.92	8.41	8.13	8.82	10.18	12.20	10.31	10.37	9.82	13.21	15.16	13.91	13.02
AKU-19	3.49	3.84	3.92	3.86	3.77	6.12	7.80	8.35	7.92	7.54	8.37	9.53	11.21	9.66	9.69	9.20	11.42	13.26	11.62	11.37
NO-55	3.77	5.12	5.46	5.34	4.92	8.10	9.81	10.20	9.85	9.49	9.30	11.12	13.02	11.82	11.31	11.10	14.11	16.25	14.21	13.91
Mean	3.331	4.63	4.69	4.64		7.10	8.57	9.15	8.72		8.83	10.27	12.14	10.59		10.94	12.91	14.89	13.24	
	Varieties	Nitrogen	V x N			Varieties	Nitrogen	V x N			Varieties	Nitrogen	V x N			Varieties	Nitrogen	V x N		
F- test	Sig	Sig	N.S.			Sig	Sig	N.S.			Sig	Sig	N.S.			Sig	Sig	N.S.		
S. E. (m)+	0.269	0.310	0.537			0.460	0.531	0.919			0.499	0.570	0.988			0.255	0.295	0.511		
C.D. at (5%)	0.788	0.910	-			1.348	-	-			-	1.673	2.897			0.749	0.865	-		

Table 3: On day to 50% flowering and days to field maturity of urd-bean cultivers

Treatments	Days to 50% flowering					Day to field maturity				
	N0	N1	N2	N3	Mean	N0	N1	N2	N3	Mean
TAU-I	33.30	35.30	37.70	36.00	35.50	62.00	64.30	67.30	64.70	64.50
AKU-19	30.70	32.00	33.70	32.30	32.10	58.30	59.00	59.00	59.30	59.40
NO-55	35.30	36.00	39.00	36.70	36.70	75.70	77.30	77.30	78.00	77.80
Mean	33.10	34.40	36.80	35.00		65.30	66.80	66.80	67.30	
	Varieties	Nitrogen	V x N			Varieties	Nitrogen	V x N		
F- test	Sig	Sig	N.S.			Sig	Sig	N.S.		
S. E. (m)+	0.340	0.390	0.680			0.460	0.530	0.930		
C.D. at (5%)	0.990	1.150	-			1.360	1.570	-		

Table 4: Effect of nitrogen on number of nodules/plant of urd-bean cultivars

Treatments	20 DAS					35 DAS					50 DAS				
	N0	N1	N2	N3	Mean	N0	N1	N2	N3	Mean	N0	N1	N2	N3	Mean
TAU-I	7.19	11.24	12.04	10.51	10.24	10.22	13.20	13.18	13.69	12.57	6.17	7.87	10.24	9.20	8.37
AKU-19	6.66	10.27	11.40	10.20	9.63	10.14	12.42	14.33	15.40	13.07	8.20	12.15	10.31	13.28	10.98
NO-55	7.92	12.21	12.21	12.48	11.20	11.31	14.27	15.22	14.71	13.87	5.16	5.95	10.24	10.16	7.87
Mean	7.25	11.24	11.88	11.07		10.55	13.29	14.24	14.60		6.51	8.66	10.26	10.88	
	Varieties	Nitrogen	V x N			Varieties	Nitrogen	V x N			Varieties	Nitrogen	V x N		
F- test	Sig	Sig	N.S.			Sig	Sig	N.S.			Sig	Sig	N.S.		
S. E. (m)+	0.408	0.472	0.817			0.646	0.746	1.293			0.562	0.649	1.125		
C.D. at (5%)	1.198	1.383	-			-	1.289	-			1.650	-	-		

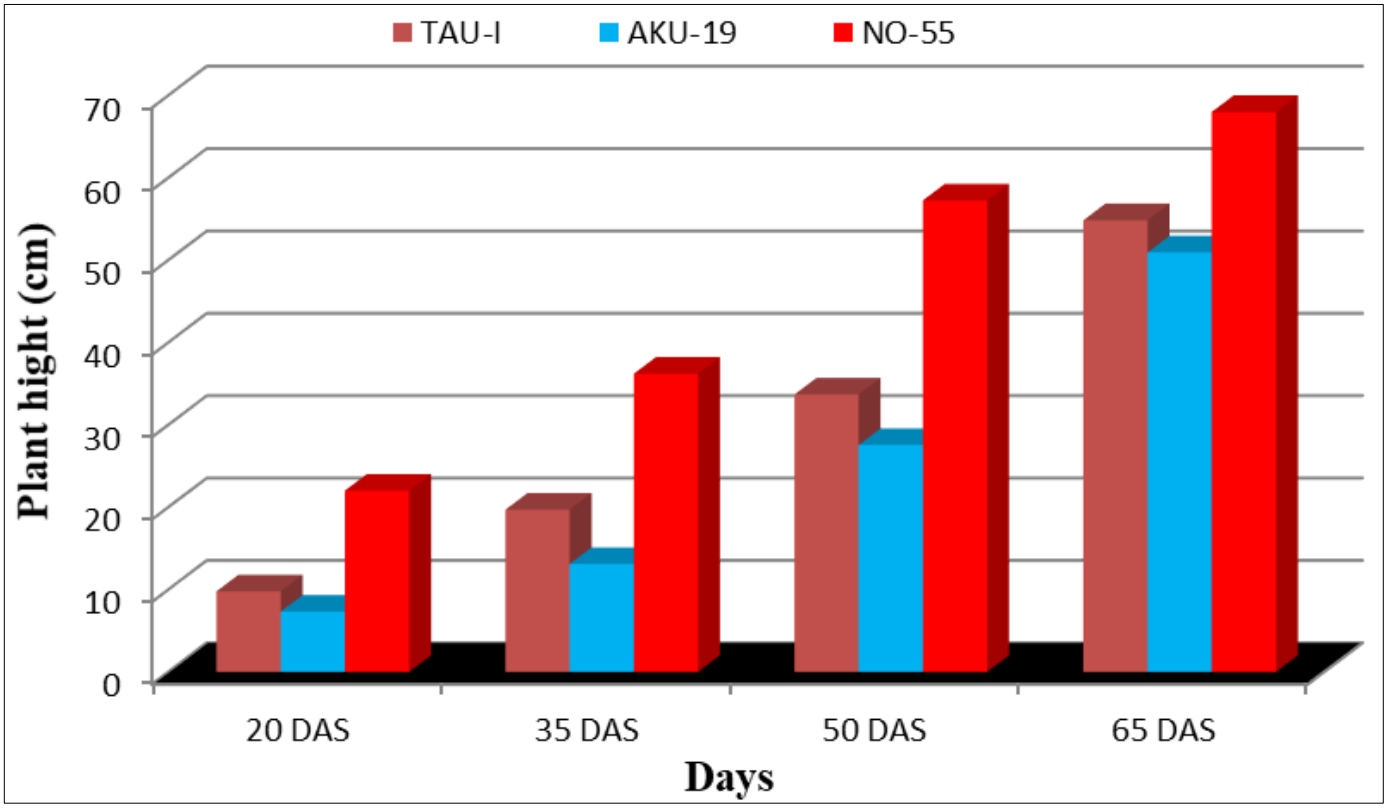

Fig 1: Effect of nitrogen on plant height/plant (cm) of urd-bean cultivars

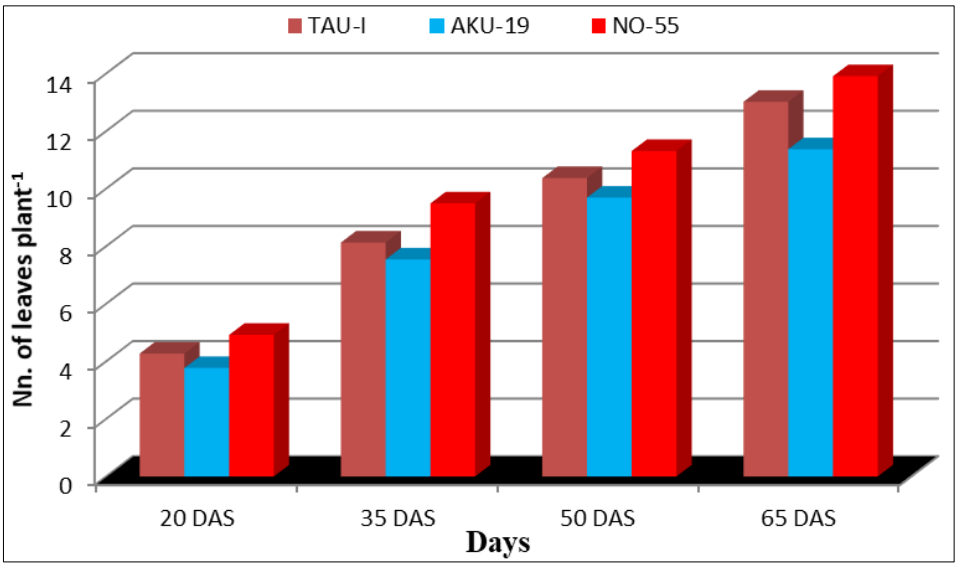

Fig 2: Effect of nitrogen on number of leaves/plant of urd-bean cultivars

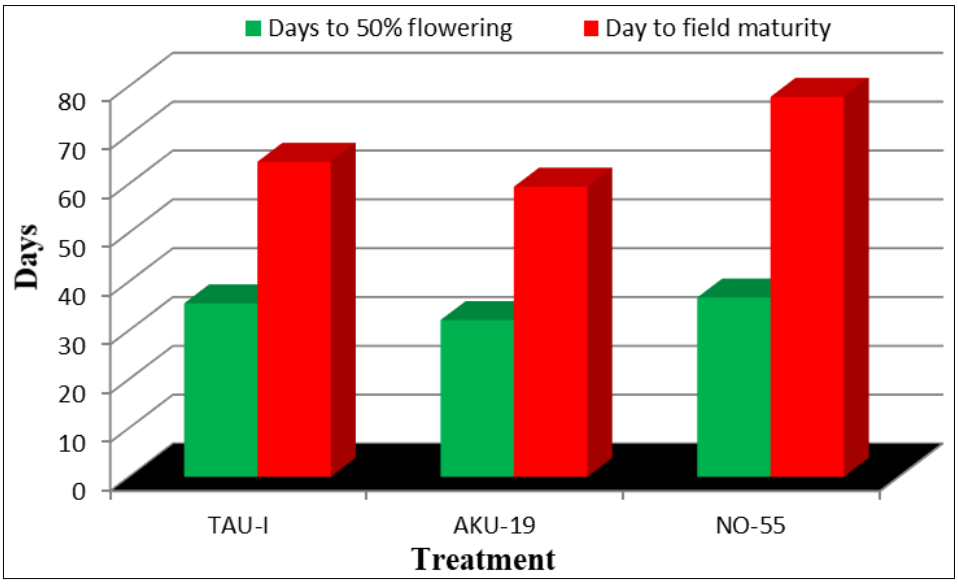

Table 3: On day to 50% flowering and days to field maturity of urd-bean cultivers

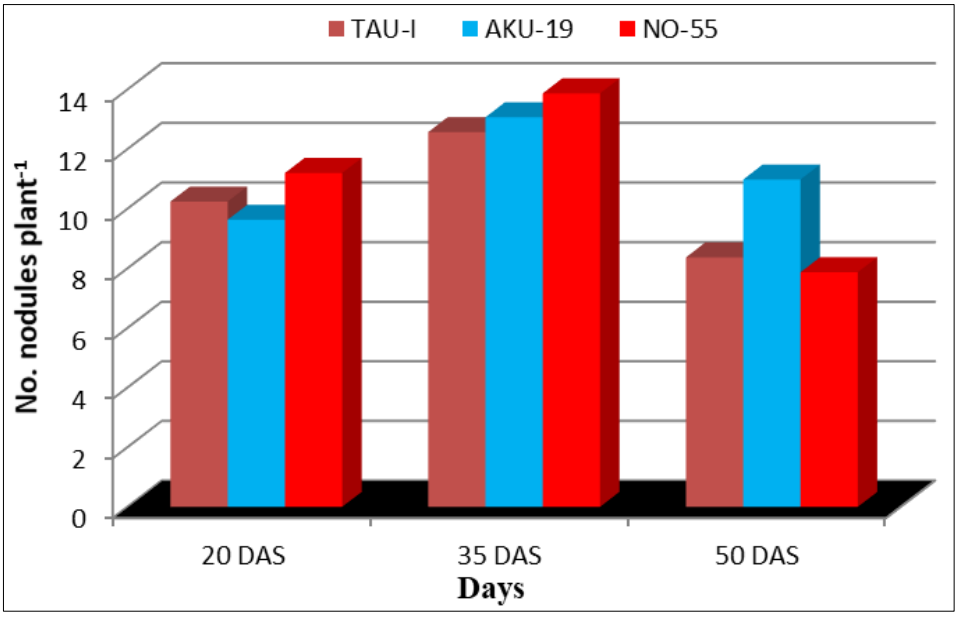

Fig 4: Effect of nitrogen on number of nodules/plant of urd-bean cultivars

Conclusion

Plant height at all stages recorded. At 20 DAS, varieties varied significantly Cultivar NO- 55 recorded maximum height followed by TAU-1 and AKU-19. Urd- bean cultivars showed significant varietal differences in respect of number of leaves plant^{-1} at 20, 35 and 65 DAS. At all stages of observations, AKU-19 recorded significantly least number of leaves plant^{-1}. The cultivar AKU-19 required significantly less number of days for flowering. NO-55 required maximum days for maturity and NO-55 showed higher nodules plant^{-1} than TAU-1 and AKU-19.

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