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Studies on Groundnut on Black Soils in the Nagarjunasagar Project, Andhra Pradesh

by

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Introduction : Groundnut is at present grown under rainfed conditions both on red and black soils in the Nagarjunasagar Project area from June-July to September-November. In Ongole area where rains extend upto November, spreading type of groundnut is grown and in the remaining area where rains normally cease by middle of October, bunch type is cultivated. The yields of *kharif* crop are generally low. With the availability of water for irrigation from the Nagarjunasagar Project in the *rabi* season it is possible to cultivate groundnut in the project area in this season. Information on the suitability of the variety, optimum time of sowing, spacing, manurial requirements etc., relating to irrigated groundnut, is not available. To obtain data on these aspects, investigations were carried out on the Project Development and Demonstration Farm, Amaravathi, Guntur district and the results are presented.

Materials and Method : The experiments were conducted on black soils of 3 to 4 feet depth. The top foot of the soil contains 50% clay and it increases to 59% in the fourth foot. The pH ranges from 8.2 to 8.5. The organic matter

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and the total nitrogen are 0.6% and 0.04% respectively. The available P_2O_5 is 10 to 16 lb per acre and the available K_2O is 60 to 150 lb. The free lime content is 10 to 15%. The soils have high capacity to retain moisture.

Bunch varieties of TMV 2, Spanish Improved and the Local, and spreading varieties of TMV 3 and TMV 4 were tested for two years during 1963-64 and 1964-65 in *kharif* season. Ten tons of FYM, 20 lb of N in the form of Ammonium Sulphate, 20 lb of P_2O_5 in the form of super phosphate and 50 lb of K_2O in the form of muriate of potash were applied per acre prior to sowing. A spacing of 6" x 6" for bunch varieties and 9" x 9" for spreading varieties was adopted. One irrigation was given to the crop raised during 1964-65 in the month of July when the moisture in the soil was low and plants were wilting.

Results: (a) *Varietal Trials*: TMV 2, an improved bunch variety, gave increased yield over others. Vide Table 1.

TABLE 1. Pod yields (kg/acre)

S. No.	Variety	1963-64	1964-65	Average of two years	Percentage over control
1.	TMV2	400	387	394	123.1
2.	TMV3	297	303	300	93.8
3.	TMV4	305	327	316	98.8
4.	Spanish Improved	262	279	271	84.7
5.	Local	330	309	320	100.00

(b) *Effect of Seasons*: The pod yields in *rabi* season were nearly three times higher than in *kharif*. Other attributes such as number of pods per plant, shelling percentage, weight of pods and seeds and percentage of pods to total dry matter were also higher in *rabi* than in *kharif* season. Vide Table 2.

TABLE 2. Observation on yields, pod numbers etc., between *kharif* and *rabi* season on TMV 2 (From manurial experiment)

S. No.	Season	No. of pods per plant	Shelling %	Weight of 500 pods (g)	Weight of 1000 seeds (g)	% of pods to total dry matter	Yield of pods (kg/acre)
1.	<i>Kharif</i> (Means of 3 seasons)	7	69.3	264	209	25.4	312
2.	<i>Rabi</i> (Mean of 3 seasons)	15	76.3	390	332	52.8	990
Percentage increase over <i>kharif</i> season		114.3	7.0	47.7	58.9	27.4	217.3

(c) *Time of Sowing and Spacing Trials*: A split plot experiment combining twelve different times of sowings and six spacings was conducted with TMV 2 for three years from 1962-'64 to 1965-'66. Manures and fertilizers were applied as described under varietal trials. Irrigations were given as and when necessary since the sowings were done from September. The results are furnished in Table 3.

TABLE 3. *Pod yields (kg / acre).*

S. No.	Date of sowing	1963-64	1964-'65	1965-'66	Mean of three years
1.	1 September	248	—	—	—
2.	15 September	454	—	—	—
3.	1 October	435	—	—	—
4.	16 October	373	321	1023	572
5.	1 November	370	474	1149	664
6.	16 November	470	586	1157	738
7.	1 December	674	774	873	774
8.	16 December	646	817	848	770
9.	1 January	573	771	684	676
10.	16 January	—	601	384	—
11.	1 February	—	480	367	—
12.	16 February	—	292	395	—
	S.E.	73.42	7.4	34.4	27.2
	C.D. at 0.05	164.00	22.2	73.00	61.0

An examination of the above data reveals that during 1963-'64, sowings from 1st December to 1st January have given the highest yield. During 1964-'65 sowings on 16th December has given significantly higher yield followed by those done on 1st December and 1st January. During 1965-'66, sowings on 16th November and 1st November have given significantly superior yield followed by sowings done on 16th October than all other sowings. The mean data for the three years reveal that sowings from 16th November to 16th December have produced the maximum yields.

TABLE 4. *Pod yields (Kg/per acre)*

S. No.	Spacings	1963-64	1964-65	1965-66	Mean for three years
1.	6"×6"	728	749	1164	880
2.	6"×9"	641	686	1075	801
3.	6"×12"	488	636	1002	709
4.	9"×9"	481	615	945	680
5.	9"×12"	450	558	831	613
6.	12"×12"	337	500	717	518
	S. E.	42.41	11.88	37.82	22.94
	C. D. at 0.05	85	24	76	45

The data show that 6"×6" spacing has produced significantly higher yield than all other spacings. The mean yield for all the three years also has shown similar trend.

(d) *Manurial Trials*: A split plot confounded experiment with 81 treatments was laid out with TMV 2 groundnut both in *kharif* and *rabi* season for three years from 1963-64 to 1965-66 adopting a spacing of 9"×6". The treatments included N at 0, 20 and 40 lb/acre, P₂O₅ at 0, 30 and 60 lb/acre, K₂O at 0, 30 and 60 lb/acre, and FYM at 0, 5,000 and 10,000 lb/acre and all their possible combinations. These were broadcast before sowing and incorporated with *dantulu*. The crop was sown in June in *kharif* season and in December in *rabi* season. As there was sufficient rain irrigations were not given for *kharif* crop except for one irrigation in 1964-65, while *rabi* crops received seven irrigations totalling about 21 acre-inches of water.

TABLE 5. *Kharif season Pod yields - (kg/per acre)*

Treatment (lb/acre)	Year			Mean of 3 years
	1963	1964	1965	
N ₀	460	179	139	259
N ₂₀	492	227	277	332
N ₄₀	522	228	284	345
S. E.	3.7	7.9	6.9	11.3
C. D. O. 05	38.4	22.6	19.8	23.0

TABLE 6. *Rabi season Pod yields (kg | per acre)*

Treatment (lb/acre)	Year			Mean of three years
	1963-64	1964-65	1965-66	
N ₀	1037	1009	714	920
N ₂₀	1111	1100	817	1009
N ₄₀	1154	1109	842	1035
P ₀	1102	1020	765	962
P ₃₀	1088	1111	817	1005
P ₆₀	1132	1087	792	1004
S.E.	25.3	23.7	22.1	13.7
C.D.=0.05	72.2	46.5 **	63.0	27.0

** Significant to P₂ O₅ also.

From the above tables, it is seen that applications of 20 and 40 lb of N per acre both in *kharif* and *rabi* seasons have increased the yields over 'O' N treatments. The differences between 20 N and 40 N treatments were not

statistically significant in both the seasons although numerically 40 N has produced slightly higher yields. Out of 6 seasons, response to P_2O_5 was observed only in *rabi* 1964-'65. Applications of 30 lb and 60 lb of P_2O_5 per acre were significantly superior to '0' lb of P_2O_5 , but there was no difference between the yields obtained from applications of 30 lb of P_2O_5 and 60 lb of P_2O_5 per acre. The mean yields of 3 years have shown that the treatments 30 P_2O_5 and 60 P_2O_5 have produced significantly higher yields over the treatment '0' P_2O_5 . The difference between the yields of the treatments 30 P_2O_5 and 60 P_2O_5 was not statistically significant.

Discussion: Varietal Trial: Spanish Improved has big-sized pods. Under irrigated conditions in clay soils, size of the pod gets reduced considerably. Pod development in spreading types is sparse. These might be the causes for low yields in the above varieties. Only TMV2 was found to be eminently suited for irrigated black soils under Nagarjunasagar Project.

It is interesting to observe that there is considerable difference between *kharif* and *rabi* season in the number of pods developed per plant, percentage of pods produced to the total dry matter, shelling percentage and weight of pods and seeds. In every case, *rabi* season has given better results than *kharif* season. The greater number of pods developed per plant, the high proportion of pods to total dry matter, more weighty pods and seeds produced are responsible for higher yields in *rabi* than in *kharif* on black soils. Controlled moisture, bright sunshine, better utilisation of nutrients due to absence of rain and cloudy weather, favourable soil conditions for the *Rhizobium* to fix up atmospheric nitrogen and perhaps congenial weather for pollination and fertilisation of the crop might have contributed for increased yields in *rabi* than in *kharif*.

Black soils develop small cracks in *rabi* season in spite of irrigation. The pegs that penetrate into these crevices will not develop pods. Loss due to this phenomena is, however, only 4 to 7 kg per acre and is negligible.

Besides giving high yields, the produce obtained in *rabi* season is cleaner and has better quality when compared to *kharif*. Therefore cultivation of groundnut in *rabi* season should be encouraged on black soils.

Time of Sowing Trials: An analysis of the data on time of sowing indicates that although groundnut has definite time for sowing in *rabi*, yet, it is variable slightly from year to year. Under the conditions of the experiment, in the first year 1st December to 1st January was the best period for sowing. In the second year sowing on 16th December was the best and in the third year sowing on 16th or on 1st November was the best. These differences appear to be due mostly to moisture and temperature conditions of the soil which are

influenced by rainfall and weather that were prevalent after September. During 1964-'65 a total quantity of 980.6 mm of rain was received from June to November and rains extended upto the end of November. The rainfall during November was 49.2 mm. During 1965-'66, the rainfall for the same period was 798.7 mm and the rains ceased by 17th October. The rainfall during October was 34.6 mm. The soil temperatures at 15 cm depth during November and December in 1964-'65 were 26.1°C and 23.5°C respectively, and in 1965-'66 they were 27.5°C and 25.3°C for the corresponding months.* The early cessation of rains during 1965-'66 appears to have provided favourable moisture and temperature conditions for the plants to establish and grow. Therefore in the years when the rains cease by middle of October, groundnut can be sown from 1st to 16th November and in the years when the rains extend upto November, it can be sown from 1st December to 1st January. Thus depending upon the intensity and distribution of rainfall and weather conditions specially after September, the crop can be sown on black soils from 1st November to 1st January under Nagarjunasagar Project.

Spacing Trials: Decreased spacing gave increased yields of pods. This is in accordance with the observation made by Nijhwan (1963). Close spacing of 6" × 6" accommodated a high population of 1.74 lakhs per acre and produced heavy yields. In the experiment, it was observed, that closer spacing of 6" × 6" induced the plants to grow erectly. All the pods developed at the base of the plant and matured more or less at the same time. The proportion of mature to immature pods was low. In widely spaced crop of 12" × 12", on the other hand, the plants had a semi-erect habit, flowered for longer period and produced pods on the upper portions of the branches also. The proportion of mature to immature pods was also high. The less population and lower proportion of mature pods were chiefly responsible for low yields in widely spaced plants. Besides reduction in yields wide spacing produces more immature pods which will impair the quality. Therefore close spacing of 6" × 6" is beneficial both from the point of view of yield and quality.

Manurial Trial: Black soils are low in nitrogen and organic matter and therefore response to nitrogen was observed. However, application of over 20 lb nitrogen per acre was not beneficial. Response to P_2O_6 was observed only in one season (*rabi* 1964-65) out of six seasons. The mean yields of the three years in *kharif* have shown no response to the applications of P_2O_6 while in *rabi* significant responses were obtained to the applications of 30 P_2O_6 and 60 P_2O_6 per acre over '0' P_2O_6 . Applications over 30 lb P_2O_6 per acre does not produce any additional yield. It is not a surprise to observe

* The rainfall and soil temperatures for 1963-'64 were not recorded for want of meteorological equipment.

that groundnut has not responded to potash on black soils continuously in all the six seasons. Katarki and Banhatti (1965) made similar observations on black soils in Mysore State. The soils are medium rich in available potash which is perhaps sufficient to meet the demands of groundnut crop. Therefore there is no need to apply potash to groundnut grown on such soils.

Summary and Conclusions: (1) TMV2, a bunch variety, is best suited for black soils of 3-4' depth under Nagarjunasagar Project. (2) Pod number per plant, shelling percentage, weight of pods and seeds and proportion of pods to total dry matter are higher in *rabi* than in *kharif* season. (3) Yield of pods are three times higher in *rabi* than in *kharif* seasons. Besides the produce obtained in *rabi* is cleaner and has better quality than in *kharif*. Therefore it is advisable to grow the crop in *rabi* than in *kharif* under irrigation to obtain high yields of good quality. (4) Sowing from 1st November to 1st January is the best period for groundnut on black soils in *rabi* season under Nagarjunasagar Project. (5) A spacing of 6" x 6" gives the highest yield and therefore it should be adopted. If inter-cultivation with *dantis* is to be done, the plants may be spaced at 9" x 6". Decreased spacing produces less number of immature pods and better quality. (6) Application of 20 lb N and 30 lb P₂O₅ per acre is the optimum for black soils under Nagarjunasagar Project. There is no need to apply potash to groundnut unless the soil tests reveal a very low content of this element.

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