Mechanization in rainfed groundnut through farmer's participatory approach

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ABSTRACT

On Farm Experiment was conducted at Ammayenthal village of Thirupathur block of Sivagangai District, Tamil Nadu during *Kharif* 2010 season to study the effect of mechanization in rainfed groundnut (decorticator, seed drill sowing) for drudgery reduction against conventional method, foliar nutrition with groundnut consortia and split application of N and K fertilizers on yield and yield attributing characters of rainfed groundnut. The On Farm Experiment was laid out in Factorial Randomized block Design with three replications. The soil of the experimental filed was sandy loam in nature. The treatments consisted of two shelling practices *viz*., farmers practice (manual hand shelling) and shelling through manual decorticator, two crop establishment methods such as manual sowing with country plough and seed drill sowing, two split application of N and K fertilizer *viz*., farmers practice (full basal) and three splits at basal, flowerings and pegging stage and two foliar nutrition *viz*., farmers practice (foliar spraying of 2.0 per cent DAP at fifty per cent flowering) and foliar nutrition with groundnut consortia at fifty per cent flowering and pegging stage. The results of the on farm experiment revealed that plant density load per unit area, leaf area index, fertility co-efficient, number of pods per plant, pegging percentage, shelling percentage, pod yield and haulm yield was significantly influenced by seed drill sowing, foliar nutrition with nutrient consortia and split application of N and K fertilizers. Groundnut shelling through manual decorticator had registered the lowest kernel damage and highest plant density per unit area as compared to conventional method of sowing. Whereas, lower yield and yield attributing characters were noticed with farmers practice. Significant interaction between crop establishment methods and nutrient management practices was observed and crop established through seed drill sowing and foliar nutrition with nutrient consortia and split application of N and K fertilizers gave maximum Benefit Cost Ratio (BCR) and higher net return as compared to rest of the treatments.

Key words: Crop establishment, nutrient consortia, decorticator and split application.

Traditional methods of groundnut cultivation under rainfed condition require huge number of laborers for all the operations, ultimately leads to increase in cost of cultivation as compared to other crops. In recent past, acute shortage of labour particularly during peak period of cultivation is a major problem being faced by the groundnut farmers. Hence, the area under groundnut cultivation is declined and farmers searching for alternate crop which does not require much labours. Under these situations farm mechanization is one of the major activities which can reduce the cost of cultivation considerably and increase the productivity by use of improved implements and perform timely operations at different stages of crop growth besides taking advantage of favourable climatic conditions. In Tamil Nadu, groundnut farmers are adopting the traditional practice of farm operations. At present, shelling operation is carried out by manually and this process is highly labour oriented, costlier, time consuming and cumbersome process. Soon after receiving the monsoonal rainfall (June-July), most of the farmers are not adopting manual shelling owing to paucity of labourers and majority of the farmers are procured groundnut kernels from oil mills/traders which is used as seed materials for sowing which results in poor germination, poor establishment and highly admixture in nature which leads to reduction in crop productivity. Whereas, groundnut sowing is carried out either dibbling the seed manually with the help of hand hoe or sowing the seeds behind the country plough. The disadvantages of this method are utilization of higher seed rate, non-uniformity in plant density and difficulty in adopting the improved

intercultural tools for weeding. Therefore, introduction and popularization of efficient and inexpensive implements for shelling and line sowing of groundnut seeds are paramount important and need of the hour. Hence, utilization of seed drill in groundnut cultivation against hand dibbling method will ensure uniformity in plant population. It is imperative that split application of N and K fertilizers and foliar nutrition with nutrient consortia will improve the filling efficiency and it can also used as a means of supplying supplemental doses of minor and major nutrients, plant hormones, stimulants and other beneficial substances to groundnut. Hence, the present investigation was carried out to find out the effect of farm implements and nutrient management practices for maximizing the productivity of groundnut under rainfed condition.

MATERIALS AND METHODS

On Farm Experiment was conducted at Ammayenthal village of Thirupathur block of Sivagangai District, Tamil Nadu during *Kharif* 2010 season to study the effect of mechanization in rainfed groundnut (decorticator, seed drill sowing) for drudgery reduction against conventional method, foliar nutrition with groundnut consortia and split application of N and K fertilizers on yield and yield attributing characters of rainfed groundnut. The On Farm Experiment was laid out in Factorial Randomized block Design with three replications. The soil of the experimental filed was sandy loam in nature, low in available nitrogen, medium in phosphorus and potassium. The treatments consisted of two shelling practices *viz*., farmers practice (manual hand shelling) and shelling through manual decorticator, two crop establishment methods such as manual sowing with country plough and seed drill sowing, two split application of N and K fertilizer *viz*., farmers practice (full basal) and three splits at basal, flowerings and pegging stage and two foliar nutrition *viz*., farmers practice (foliar spraying of 2.0 per cent DAP at fifty per cent flowering) and foliar nutrition with groundnut consortia at fifty per cent flowering and pegging stage. The groundnut variety TMV 7 was used for this on farm experiment. Farm yard manure (FYM) @ 12.5 t ha^{-1} was applied commonly to all the treatments. In addition, a fertilizer schedule of 10:40:45 kg N, P_2O_5 and K_2O ha^{-1} and gypsum (400 kg ha^{-1}) were kept constant for all the treatments. The common fertilizers used were Urea (46 per cent nitrogen), Single Super Phosphate (16 per cent phosphorus) and Muriate of Potash (60 per cent potassium) for the supply of nitrogen, phosphorus and potassium, respectively. Leaf Area Index (LAI) was computed from the selected five plants by measuring the leaf length and leaf breadth of the third fully opened leaf from the top and LAI was calculated by using the given formula as suggested by Padalia and Patel (1980). The pegging and pod setting percent was computed by using the formula suggested by Buung Han Choi and Kyu Young Chang (1997).

Particulars	**Value**
p^H	6.5
EC (dS m^{-1})	4.0
Organic carbon (%)	0.41
Nitrogen (kg ha^{-1})	210 kg ha^{-1}
Phosphorus (kg ha^{-1})	21 kg ha^{-1}
Potassium (kg ha^{-1})	225 kg ha^{-1}
Textural class	Sandy loam
Bulk density (g CC-1)	1.49

To estimate shelling per cent, the pods of the sample plants of net plot area of each treatment were shelled separately. The kernel weight to the pod weight was computed and the mean for each treatment was expressed in percentage. To estimate SMK hundred kernels from each treatment were randomly selected and the sound matured kernels (SMK) were separated and expressed in per cent. To determine the number of kernels $ounce^{-1}$, a unit of 28.5 gram weight containing number of kernels were counted and expressed as number of kernels per ounce. The harvested pods from the net plot were sun dried, cleaned and the pod yield was recorded for the individual treatment after drying to 12 per cent seed moisture and expressed in kg ha^{-1}. After stripping the pods, the haulms in the net plot area were left in the field to sundry for three days. The dry weight of haulms of each treatment was recorded and expressed in kg ha^{-1}. Adequate prophylactic plant protection measures were taken up against pests and diseases as per the recommendation.

RESULTS AND DISCUSSION

There existed a significant difference between the two crop establishment methods with respect to LAI. Between the crop establishments methods studied, the highest LAI was observed with seed drill sowing (9.32) as compared to hand dibbling method (8.21) at fifty per cent flowering stage.

Table 2. Time and labour requirement of shelling operation

Particulars	Hand shelling	Manual Decorticator	Machine shelling
Time Taken	**2 days**	**1.0 Hour**	**40 Min**
Kernel Damage	**0.5 %**	**1.9 %**	**3.10%**
Labour involved	**10**	**2**	**-**
Cost (Rs.)	**600**	**120**	**250**

Table 3. Time and labour requirement of different sowing operation

Particulars	Manual Sowing	Country Plough	Seed Drill Sowing
Time Taken	8 Hours	1.0 Hour	40 Min
Seed Rate	50 Kg	50 Kg	40 Kg
Labour involved	15	2	1
Cost (Rs.)	1200	940	500

Table 4. Effect of mechanization on yield and yield attributes of rainfed groundnut

Treatment	LAI	Total pegs plant^{-1}	Matured pods plant^{-1}	Pegging Per cent	Shelling Per cent
Shelling technique					
S1. Hand shelling	7.68	38.52	28.8	40.95	71.32
S2. Groundnut decorticator	8.19	43.34	33.1	44.28	72.00
SEd.	0.21	0.87	0.55	1.20	1.32
CD (p=0.05)	0.43	1.78	1.14	2.44	NS
Crop establishment method					
C1. Manual Dibbling	8.21	32.38	25.1	36.02	72.15
C2. Seed drill sowing	9.32	40.48	35.6	44.21	78.20
SEd.	0.21	0.87	0.55	1.20	1.32
CD (p=0.05)	0.43	1.78	1.14	2.44	2.70
Foliar nutrition					
F1. DAP 2 Per cent at flowering	7.51	34.48	30.5	38.23	73.30
F2. Groundnut consortia (50% flowering and Pegging)	8.01	36.39	32.4	42.01	75.60
SEd.	0.21	0.87	0.55	1.20	1.32
CD (p=0.05)	0.43	1.78	1.14	2.44	NS
Split application of N and K					
S1. Farmers practice	7.48	30.42	27.5	34.50	71.40
S2. Two Splits (50% flowering and Pegging)	7.79	35.45	32.2	36.41	74.60
SEd.	0.21	0.87	0.55	1.20	1.32
CD (p=0.05)	NS	1.78	1.14	2.44	2.70

Table 5. Effect of mechanization on yield and yield attributes of rainfed groundnut

Treatment	SMK Percentage	No. of kernels per ounce	Pod Yield (Kg ha^{-1})	Haulm Yield (Kg ha^{-1})
Shelling technique				
S1. Hand shelling	60.48	55.09	1998	8436
S2. Groundnut decorticator	61.32	53.50	2056	8508
SEd.	1.12	1.35	77.9	156.9
CD (p=0.05)	NS	NS	159.2	NS
Crop establishment method				
C1. Manual Dibbling	61.90	60.25	1924	8158
C2. Seed drill sowing	62.91	56.67	2298	8722
SEd.	1.12	1.35	77.9	156.9
CD (p=0.05)	NS	2.75	159.2	320.4
Foliar nutrition				
F1. DAP 2 Per cent at flowering	61.26	54.06	1950	8431
F2. Groundnut consortia (50% flowering and Pegging)	61.95	53.13	2042	8612
SEd.	1.12	1.35	77.9	156.9
CD (p=0.05)	NS	NS	NS	NS
Split application of N and K				
S1. Farmers practice	60.66	56.98	1987	8288
S2. Two Splits (50% flowering and Pegging)	62.14	53.21	2100	8720
SEd.	1.12	1.35	77.9	156.9
CD (p=0.05)	NS	2.75	NS	320.4

The effect of different foliar nutrition and split application of N and K did significantly improve the LAI and the highest values were noticed under foliar nutrition with groundnut consortia at fifty per cent flowering stage (8.01) and split application of N and K at fifty per cent flowering and pegging stage (7.79) as compared to rest of the treatments. The total pegs plant^{-1} differed significantly between the crop establishment methods. The total pegs plant^{-1} was higher with seed drill sowing (40.48) with foliar nutrition with nutrient consortia (36.39) and split application of N and K (35.45) as compared to farmers practice.

With respect to labour utilization and time consumption, there was variation between mechanized practices and conventional method of cultivation pertinent to shelling and sowing. Sizable amount of labour and time saving was noticed in seed drill sown plot against conventional practices. The results on comparative performance of seed drill and conventional practices showed that groundnut decorticator had registered the lowest kernel damage (1.90 per cent) as against farmers practice (3.10 per cent). Moreover, time taken to decorticate 200 kg pods (2.0 hours) and labour requirement towards the shelling operation under groundnut decorticator (2 women labour) was found to be superior over conventional practice. As a result, remarkable improvement in productivity of 2056 and 2298 was observed under decorticator and seed drill sowing operation over conventional practices.

Crop establishment methods exerted significant influence on matured pods plant^{-1}, pegging percent, shelling percent, SMK and No. of kernels per ounce. Crop established through seed drill sowing had higher number of matured pods plant^{-1}, pegging per cent, shelling percentage (35.6, 44.21, 78.20, 62.91 and 60.25, respectively) as compared to conventional method of sowing. The effect of split application on this parameter was significant. More number of matured pods plant^{-1} (32.2) was observed with split application of N and K as compared to farmer's practice (27.5). Similarly, foliar nutrition with nutrient consortia also did exhibits significant

influence on matured pods per plant (32.4). With regard to kernels ounce^{-1} split application of N and K, foliar nutrition and crop establishment methods and shelling techniques differed significantly and seed drill sowing had the least number of kernels ounce^{-1} of 56.61 while split application of n and K, foliar nutrition with groundnut consortia did register the highest number of kernels ounce^{-1} (53.21 and 53.13, respectively).

Crop establishment methods had significant influence on dry pod yield. Between the two crop establishment methods evaluated, seed drill sowing registered significantly higher dry pod yield of 2298 kg ha^{-1} as compared to hand dibbling (1924 kg ha^{-1}). The percentage of increase was 19.5 over farmers practice. Split application of N and K at basal, flowerings and pegging stage exerted a significant influence on the dry pod yield. Significantly higher pod yield of 2100 kg ha^{-1} was obtained with split application of N and K than that of 100 per cent basal application (1987 kg ha^{-1}). The percentage of increase was 5.68 over 100 per cent basal application. Shelling techniques and foliar nutrition also did influence the dry pod yield and the highest values were noticed shelling through decorticator (2056 kg ha^{-1}) and foliar nutrition with groundnut consortia at flowering and pegging stage (2042 kg ha^{-1}) as compared to control treatments.

In the present study, split application of N and K resulted in significantly higher yield as compared to 100 per cent basal application. There might be leaching and other losses under basal application (Kathirvelan and Kalaiselvan 2007). But such losses might be avoided under split application and hence higher yield was obtained. Split application also prolonged the life of leaves in spite of heavy sink demand and overcoming the effects of ageing as reported by Reddy *et al*. (1981). Further, the increased yield obtained under split application may be ascribed to higher dry matter production obtained from the present investigation. Higher yield in groundnut owing to split application of K was also observed by Dubey and Shinde (1986). Potassium application also delayed the senescence of leaves and increased the LAI and sink intensity. Similar results were also reported by Balasubramanian (1985).

Significant difference on haulm yield between the crop establishment methods was noticed. Similar to pod yield, seed drill sowing registered higher haulm yield of 8722 kg ha^{-1} compared to hand dibbling method (8158 kg ha^{-1}). The effect of split application on haulm yield was significant. Split application of N and K at basal, flowerings and pegging stage and foliar nutrition with groundnut consortia had increased haulm yield (8720 kg ha^{-1} and 8612 kg ha^{-1}) as compared to 100 per cent basal application and foliar nutrition with DAP 2.0 per cent spray (8288 kg ha^{-1} and 8431 kg ha^{-1}). Cost involved for sowing under seed drill method was Rs. 900 as against conventional sowing (Rs. 2750). Gross return, returns above variable cost and benefit cost ratio varied among the treatment combinations. Crop establishment through seed drill along with utilization of groundnut decorticator, foliar nutrition with nutrient consortia and split application of N and K gave higher gross return, returns above variable cost and benefit cost ratio (3.56) as compared to other treatments.

CONCLUSION

Based on above findings, it could be concluded that crop establishment through seed drill combined with decorticator shelling, foliar nutrition with groundnut consortia and split application of N and K had recorded higher yield attributing characters and yield of groundnut owing to timeliness of critical operations, efficient utilization of inputs besides reducing labour drudgery.

REFERENCES

Balasubramanian, V. 1985. Potassium drought tolerance, a national review. In: Potassium and Plant Physiology. Potash Research Institute of India. Gurgaon, India. pp. 47-56.

Buung Han Choi and Kyu Yong Chang. 1997. Effect of polyethylene film mulching on flowering and yield of groundnut in Korea. *International Arachis Newsletter,* 17: 49-51.

Dubey, S.K. and D.A. Shinde. 1986. Effect of phosphate and potassium application on pod yield and uptake of micronutrients by groundnut. *J. Indian Soc. Soil Sci.,* 34: 302-304.

Kathirvelan,P and P.Kalaiselvan. 2007. Studies on Agro Management Techniques for Confectionery Groundnut under Irrigated Condition. *Research Journal of Agriculture and Biological Sciences*, 3(1): 52-58, 2007

Padalia, M.R. and C.L. Patel. 1980. Note on length-width method for estimating leaf area of groundnut. *Indian J. Agrl. Sci.*, 50: 880-882.

Reddy, P.R., L.K. Rao and I.V. Subbarao. 1981. Nitrogen nutrition in groundnut. *Indian J. Exp. Biol.*, 19: 966-970.