

Original Research Article

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## Effect of Integrated Nutrient Management on Productivity of Groundnut (*Arachis hypogaea L.*) and Soil Physical Properties in Bastar Plateau

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### ABSTRACT

A field experiment was conducted during *kharif*, Season of 2016 to study the effect of integrated nutrient management in groundnut at Upland field under AICRP-Dry land Agriculture, S.G. College of Agriculture and Research Station, Kumrawand, Jagdalpur, Bastar (C.G.). The experiment comprised 10 treatment combinations T<sub>1</sub>-control, T<sub>2</sub>-GRD (30:60:30::NPK kg/ha), T<sub>3</sub>-GRD+ZnSO<sub>4</sub>@25kg/ha, T<sub>4</sub>GRD + FYM@5t/ ha in furrow, T<sub>5</sub>-GRD+FYM@5t/ha in furrow +ZnSO<sub>4</sub>@25kg/ha, T<sub>6</sub>-50%GRD +FYM @5t/ha in furrow, T<sub>7</sub>-50%GRD +ZnSO<sub>4</sub>@25kg/ha +FYM @5t/ha in furrow, T<sub>8</sub>-100%GRD +Lime@3q/ ha +FYM @5t/ha in furrow, T<sub>9</sub>-100%GRD +MgSO<sub>4</sub>@15 kg/ha+ FYM @5t/ha in furrow and T<sub>10</sub>- 100% GRD + lime@3q/ha+ MgSO<sub>4</sub>@15kg/ha+ FYM 5t/ha in furrow. The maximum pod yield (20.52qha<sup>-1</sup>) was recorded under treatment 100%GRD+ lime@ 3q/ha+MgSO<sub>4</sub>@ 15kg /ha+FYM5t/ha in furrow (T<sub>10</sub>), The maximum haulm yield (33.07 q/ ha<sup>-1</sup>) was recorded under 100%GRD+ Lime@3q/ha+FYM 5t/ha in furrow (T<sub>8</sub>) and The maximum harvest index (38.8%) was recorded under 100%GRD+FYM@5t/ ha in furrow (T<sub>4</sub>). Different fertility treatments had significant effect on growth, yield attributes, yield and oil content in groundnut.

### Keywords

Integrated nutrient management, Organic manure, Yield attributes, Oil content, Groundnut, Growth

### Article Info

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### Introduction

Groundnut (*Arachis hypogaea L.*) is one of the major oilseed crop in India. Although India ranks 1st in the world in respect of area and production, however, ranks 8th in productivity (Sonawane *et al.*, 2010). It is a valuable cash crop planted by millions of small farmers because of its economic and

nutritional value. Groundnut which helps to enrich the soil nitrogen and ultimately maintain soil health. Its kernels are rich source of edible oil and protein. It contains on an average 45-50% oil, 25-30% protein, 20% carbohydrate, 5% fiber and ash and is a rich source of Ca, Fe, vitamins A, B, E, and K, which make a substantial contribution to human nutrition. About two third of world

production is crushed for oil and remaining one third is consumed as food. Oilseed and are the second largest agri-commodity after cereals and value about 5% of gross national product and nearly 10% value of all agricultural products put together.. Groundnut is essentially a tropical crop. It requires a long and warm growing season. The most favorable climatic conditions for groundnut are a well distributed rainfall of at least 50 cm. during growing season, abundance of sunshine and relatively warm temperatures (25-28°C). Lower temperatures are not suitable for its proper development. During ripening period it requires about a month of warm and dry weather. Groundnut thrives best in well-drained sandy and sandy loam soils, as light soil helps in easy penetration of pegs and their development and also harvesting. Clay or heavy soils are not suitable for this crop, as they interfere in penetration of pegs and make harvesting difficult. Groundnut gives good yields in the soil with pH between 6.0-6.5. Groundnut is a unique and important oilseed crop of India. In India, groundnut is cultivated in 5.48 m ha with a production of 5.43 m t and productivity of 991 kg ha<sup>-1</sup> (2009-10).Groundnut is grown on nearly 23.95 million ha worldwide with the total production of 36.45 million tons and an average yield of 1520 kg/ha in 2009 (FAOSTAT 2011).

### Materials and Methods

A field experiment was conducted during *kharif* season of 2016 at Upland field under AICRP-Dry land Agriculture, S.G. College of Agriculture and Research Station, Kumrawand, Jagdalpur, Bastar (C.G.) The soil of the experimental site was sandy loam (52% sand, 26% silt and 22% clay), slightly acidic in reaction (pH 4.8), medium in organic carbon (0.61%), available nitrogen (205 kg/ha), available phosphorus (12.3 kg/ha), medium in available potassium (198 kg/ha),

available sulphur (9.5kg/ha),available calcium(92 kg/ha), available Mg (96 kg/ha)and (zinc 1.2ppm) respectively. The experiment comprised 10 treatment combinations. T<sub>1</sub>-control,T<sub>2</sub>-GRD (30:60:30::NPK kg/ha), T<sub>3</sub>-GRD+ZnSO<sub>4</sub> @25kg/ha, T<sub>4</sub>GRD + FYM@5t/ ha in furrow, T<sub>5</sub>-GRD+FYM@5t/ha in furrow +ZnSO<sub>4</sub>@25kg/ha, T<sub>6</sub>-50%GRD +FYM @5t/ha in furrow, T<sub>7</sub>-50% GRD +ZnSO<sub>4</sub>@25kg/ha +FYM @5t/ha in furrow, T<sub>8</sub>-100%GRD +Lime@3q/ ha +FYM @5t/ha in furrow, T<sub>9</sub>-100%GRD +MgSO<sub>4</sub>@15 kg/ha+ FYM @5t/ha in furrow and T<sub>10</sub>- 100% GRD + lime@3q/ha+ MgSO<sub>4</sub>@15kg/ha+ FYM 5t/ha in furrow.

These treatments were laid out in randomized block design with four replications, using seed rate 100 kg/ha and sown on June 21, 2016and harvested on Oct. 18, 2016. The FYM was applied 25 days before crop sowing. The calculated quantity of chemical fertilizers as per treatment was applied at the time of bed preparation in respective treatment. Urea DAP and MOP were used as source of nitrogen, phosphorus, and potassium respectively.

Oil was extracted from seeds of groundnut of each plots with the help of Socs plus solvent extractor using hexane as solvent.The percent of oil present in a sample was calculated with the help of following formula:

$$\text{Oil content (\%)} = \frac{W_2 - W_1}{W} \times 100$$

Where,

W<sub>1</sub> = Initial weight of beaker

W<sub>2</sub> =Final weight of beaker (beaker + oil)

W = Weight of powdered sample (2g)

## Results and Discussion

### Yield attributes and oil content

#### Yield attributes

The effects of different levels of fertilizers and manures on a significant effect on number of pod/plant. The maximum values of these parameter (17.80 pods plant<sup>-1</sup>) were observed under 50%GRD+ZnSO<sub>4</sub> @ 25kg/ha+ FYM @5t/ha in furrow (T<sub>7</sub>) (Table 1). In groundnut, application of fertilizers alone or in combinations with FYM increased the pod numbers as compared to control. (Singaravel *et al.*, 2006) and (Gunri *et al.*, 2012). The research findings indicate that a suitable combination of organic and inorganic fertilizers maintain a long term soil fertility and sustain high level of productivity (Pillai *et al.*, 1985).

Application of different levels of fertilizer and manures significantly increased the yield attributes such as number of pods/plant, and 100 grain weight. The significantly highest values were obtained under 50%GRD+ZnSO<sub>4</sub> @ 25kg/ha+ FYM @5t/ha in furrow (T<sub>7</sub>) and 100%GRD+lime@3q/ha+MgSO<sub>4</sub>@15 kg/ha+FYM 5t/ha in furrow (T<sub>10</sub>) (Table 1). The same trend was also observed in pod, haulm, and biological yield. The maximum pod yield (20.52qha<sup>-1</sup>) was recorded under treatment 100% GRD+ lime@ 3q/ha+ MgSO<sub>4</sub>@ 15kg /ha+FYM5t/ha in furrow (T<sub>10</sub>). The maximum haulm yield (33.07 q/ ha<sup>-1</sup>) was recorded under 100%GRD+ Lime@3q/ha+FYM 5t/ha in furrow (T<sub>8</sub>) and The maximum harvest index (38.8%) was recorded under 100%GRD+FYM@5t/ ha in furrow (T<sub>4</sub>). This might be attributed to the favourable effect of FYM on plant growth and consequently on yield attributes. Further, FYM increased the efficiency of humification. Humic acid in FYM enhanced the availability of both native and added

macro and micronutrients in soil and thus stimulated plant growth and improved yield attributes and yield significantly. The pod, haulm and biological yields of groundnut significantly increased with application of FYM along with fertilizers. Similar results were reported by Thorve *et al.*, (2008) and Abraham *et al.*, (2010) and Singh *et al.*, (2011).

It may be due to application of inorganic N fertilizer with organic sources is known to reduce the C:N ratio and stimulate the mineralization of organic N that in turn resulted in higher yields. Similar results were reported by Badole *et al.*, (2004) and Laxminarayana *et al.*, (2005).

#### Oil content

Oil content in groundnut increased significantly due to application of different level of fertilizers and manures. The maximum oil content (49.18%) was recorded under 100%GRD +MgSO<sub>4</sub>@15 kg/ha+ FYM 5t/ha in furrow (T<sub>9</sub>) and the lowest oil content in control plot (T<sub>1</sub>) (36.3 %) (Table 1). As, oil bio synthesis is a complex process it is always difficult to modulate its content in plant through Management practices. Similar results were reported by Kachot *et al.*, (2001), Panwar *et al.*, (2007) and Basu *et al.*, (2008). Probable reason for increase in protein is that the nitrogen is an integral part of protein and phosphorus is an integral part of certain co-enzyme involved in protein synthesis. The increase in protein synthesis in groundnut is mainly due to cumulative effect of pod yield. Similar results were also noted by Zalate *et al.*, (2010)

#### Physico-chemical properties of soil

For the assessment of various physico-chemical properties of the experiment site, surface soil sample (0-15cm) were collected

randomly with the help of auger and a respective composite sample was prepared. The soil was analyzed for its initial characteristics as per the methods mentioned below and some important physico-chemical properties of the soil are given in (Table 2)The soil of the experimental site was sandy loam (52% sand, 26% silt and 22% clay),

slightly acidic in reaction (pH 4.8), midium in organic carbon (0.61%), available nitrogen (205 kg/ha), available phosphorus (12.3 kg/ha), medium in available potassium (198 kg/ha), available sulphur (9.5kg/ha),available calcium(92 kg/ha),available Mg (96 kg/ha)and (zinc 1.2ppm) respectively.

**Table.1** Effect of treatments on yield and yield attributing characters of groundnut crop

Treatment	Pod / plant	100 grain weight	Pod yield (Kg/ha)	Haulm yield (kg/ha)	Harvest index (%)	Oil content (%)
<b>Control</b>	13.30	30.31	1013	1774.00	36.3	45.65
<b>GRD (30:60:30:: NPK Kg/ha)</b>	15.60	31.92	1729.75	2798.00	38.2	47.28
<b>GRD+ZnSO<sub>4</sub>@25 kg</b>	17.30	30.71	1877	3057.50	38.0	47.75
<b>GRD +FYM@5t/ ha in furrow</b>	14.55	32.14	1890.5	2987.50	38.8	47.83
<b>GRD+FYM@5t/ha in furrow+ZnSO<sub>4</sub>@25kg</b>	16.50	32.88	1879.75	3034.00	38.3	48.23
<b>50%GRD +FYM @5t/ha in furrow</b>	13.20	32.60	1748.5	2965.50	37.1	48.13
<b>50% GRD +ZnSO<sub>4</sub>@25kg +FYM @5t/in furrow</b>	17.80	30.94	1811.75	3035.00	37.4	48.18
<b>100%GRD +Lime@3q/ ha +FYM 5t/ha in furrow</b>	14.00	34.37	2030.75	3307.50	38.0	48.88
<b>100%GRD +MgSO<sub>4</sub>@15 kg/ha+ FYM 5t/ha in furrow</b>	15.90	31.93	1917.75	3187.50	37.6	49.18
<b>100% GRD + lime@3q/ha+ MgSO<sub>4</sub>15kg/ha+ FYM 5t/ha in furrow</b>	14.23	37.27	2052.5	3292.50	38.4	49.13
<b>CV(%)</b>	19.39	3.34	7.1	3.60	6.46	1.99
<b>CD(5%)</b>	4.19	1.54	181.9	150.6	3.54	1.36
<b>CD(1%)</b>	5.79	2.12	251.4	208.1	4.48	1.87

**Table.2** Physico-chemical properties of soil

S.No.	Soil Properties	Values
<b>1</b>	Mechanical composition	
	Sand %	52
	Silt %	26
	Clay %	22
	Texture classes	Sandy loam
<b>2</b>	Bulk density	1.4
<b>3</b>	Soil pH (1:2:5)	4.8
<b>4</b>	Electrical conductivity (dSm <sup>-1</sup> at 250C)	0.22
<b>5</b>	CEC	14.1
<b>6</b>	Organic carbon (%)	0.61
<b>7</b>	Available N (kg ha <sup>1</sup> )	205
<b>8</b>	Available P (kg ha <sup>1</sup> )	12.3
<b>9</b>	Available K (kg ha <sup>1</sup> )	198
<b>10</b>	Available S (kg ha <sup>1</sup> )	9.7
<b>11</b>	Available Ca (kg ha <sup>1</sup> )	92
<b>12</b>	Available Mg (kg ha <sup>1</sup> )	96
<b>13</b>	Available Zn (ppm)	1.2

In conclusions, the application of organics and inorganics nutrients was found better and significantly influenced the growth and yield parameters of groundnut. The application of organics and inorganics nutrients influenced the growth and yield of groundnut significantly and the highest pod yield of groundnut (20.52 q/ha) were recorded maximum under (T<sub>10</sub>) 100% GRD + lime@3q/ha+ MgSO<sub>4</sub>15kg/ha+ FYM 5t/ha in furrow and the haulm yield (33.07 q/ha) were recorded maximum under(T<sub>8</sub>) 100%GRD +Lime@3q/ ha +FYM 5t/ha in furrow and the control plot experienced low pod and haulm yield of groundnut. The application of either FYM in soil significantly increased the available major nutrients (N, P and K) whereas, available micro nutrient (Zn) content in soil were not influenced significantly after harvest of the groundnut crop. The application of organics and inorganics fertilizers in soil significantly improved the oil content in groundnut seeds.

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