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Performance of groundnut to different soil fertility amendments in coastal sandy soil

S. Arunkumar[1], K. Arivazhagan [2], M. V. Sriramachadrasekharan[3]
[1]Research scholar, Dept. of Soil Science and Agricultural Chemistry, School of Agriculture, Lovely Professional University, Jalandhar, Punjab, India.
[2]Professor and Head, Dept. of Soil Science and Agricultural Chemistry, Faculty of agriculture, Annamalai university, Cuddalore, Tamilnadu, India.
[3]Professor, Dept. of Soil Science and Agricultural Chemistry, Faculty of agriculture, Annamalai university, Cuddalore, Tamilnadu, India.
arunkumarhealer@gmail.com[1]

Abstract

A field experiment was carried out using groundnut variety VRI 2 in coastal sandy soil in Pichavaram coastal village near Chidambaram which represented sandy texture and had a pH-7.44, EC-0.12 dSm^{-1} and available NPK of 139, 15 and 143 Kg ha^{-1}, respectively. The experiment conducted were nine treatments viz., T_1 – Absolute control, T_2 - 100% RDF Alone, T_3 - 125% RDF Alone, T_4 - 100% RDF + Press mud @ 10 t ha^{-1} + Sea weed extract, T_5 – 100% RDF + Vermicompost @ 6 t ha^{-1} + Sea weed extract, T_6 – 100% RDF + Coirpith Compost @ 6 t ha^{-1} + Sea weed extract, T_7 – 125% RDF + Press mud @ 10 t ha^{-1} + Sea weed extract, T_8 – 125% RDF + Vermicompost @ 6 t ha^{-1} + Sea weed extract, T_9 – 125% RDF + Coirpith Compost @ 6 t ha^{-1} + Sea weed extract. The result revealed that application of 125% RDF + Press mud @ 10 t ha^{-1} + Sea weed extract (T_7) recorded higher values in parameters viz., plant height (63.30cm), Leaf area index (1.48), Number of leaves (45.30), Dry matter production (3816), Pod yield (2157), Kernel yield (1119), nitrogen uptake (68.92), phosphorus uptake(12.64), Potassium uptake (12.64), Calcium uptake (61.57), Magnesium uptake (23.64) and BC ratio (2.88).

Keywords: Groundnut, pressmud, leaf area index and kernel yield.

1. Introduction

Groundnut (*Arachis hypogaea*), is a species in the legume family (Fabaceae) native to South America and presently grown in tropical countries. It is an annual herbaceous plant growing to 30 to 50cm tall. The leaves are opposite, pinnate with four leaflets (two opposite pairs; no terminal leaflet), each leaflet 1 to 7 cm long and 1 to 3 cm broad. The productivity of groundnut with imbalanced use of high analysis chemical fertilizers accompanied by restricted use of organic manures, which made the soils deficient in secondary and micronutrients and deteriorated the soil health (Akbari *et al.*, 2011) [1]. The bulk of oil producing in India is derived from groundnut (Rathore and Kamble, 2008) [10].

In nutritional point of view, groundnut is important because they provide essential fatty acids, and provide nutrients like carbohydrates, proteins, minerals and fat soluble vitamins (Singh *et al.*, 2011) [11]. The vermicompost is excreta of earthworm, which improve soil health and nutrient status. Vermicompost promote growth from 50% to 100% over conventional compost and 30 – 40% when compared to chemical fertilizers (Sinha *et al.*, 2010) [12].

Pressmud is a by-product from sugar mill is source for nutrients which can be used by bio composting. Thus soil application of pressmud biocompost also benefits of safe disposal of the wastes and also replenishes the soil nutrients and reduces the fertilizer cost. Pressmud contains appreciable amount of plant nutrients *viz.*, organic carbon, nitrogen, phosphorus, potassium, calcium and magnesium (Banulekha, 2007) [2].

It is estimated that 5.74 million metric tonnes of coconut are produced in the world. India is reported to produce 0.77 million metric tonnes of coconut (*Cocos nucifera*) equivalent to the availability of 0.35 million metric tonnes of fibrous husk. The combined application of composted coirpith and humic acid leads to increased production of indole acetic acid (IAA) in plants (Parasuraman and Mani, 2003) [8].

2. Materials and methods

The present investigation was carried out to find out the Performance of groundnut (*Arachis hypogea*) to different soil fertility amendments in coastal sandy soil. A field experiment was conducted at farmers field Pichavaram coastal village near Chidambaram which represented sandy texture and had a pH-7.44, EC-0.12 dS m^{-1}, Chidambaram taluk, Cuddalore district.

3. Experimental design

The experimental designs were randomized block design with three replications. The treatments were at different levels of inorganic and organic nutrients applied to soil. Treatments details given below

T_1-Absolute control

T_2-100 % RDF Alone

T_3-125% RDF Alone

T_4 -100% RDF + Press mud @ 10 t ha^{-1} + 5% Sea weed extract

T_5 -100% RDF + Vermicompost @ 6 t ha^{-1} + 5% Sea weed extract

T_6 -100% RDF + Coir pith compost @ 6 t ha^{-1}+ 5% Sea weed extract

T_7 -125% RDF + Press mud @ 10 t ha^{-1} + 5% Sea weed extract

T_8 -125% RDF + Vermicompost @ 6 t ha^{-1} + 5% Sea weed extract

T_9 -125% RDF + Coir pith compost @ 6 t ha^{-1}+ 5% Sea weed extract

Plot size: 5 x 4 m

Design: Randomized Block Design

Replications: Three

4. Results and discussion

4.1 Plant height

Among the various treatments, application of 125% RDF + Press mud at 10 t ha^{-1} + Sea weed extract (T_7) recorded higher plant height over control and other treatments on 30 DAS, 60 DAS and 90 DAS. Similar finding was noticed in number of nodules also. The increase in plant height and number of nodules in response favourable effect of pressmud on plant height could be attributed to sustained availability of major and micro nutrients with different growth hormones like gibberellins, NAA and cytokinin resulting increased plant height. This was also confirmed by Ramprakash Prasad and Panchauri (2001) [9]. The least plant height and root length was reported in control plots (T_1).

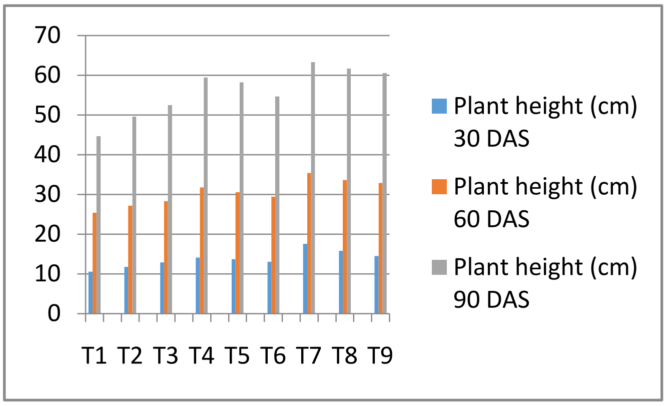

Fig.1. Plant height

4.2 Leaf area index

Among the various combinations experimented, the maximum leaf area index of 1.48 was recorded in the treatment T_7 (125% RDF + Press mud + Sea weed extract). The treatments were followed by T_8, T_9, T_4, T_5, T_6, T_3 and T_2 registering the leaf area index of 1.35, 1.26, 1.21, 1.06, 0.99, 0.95 and 0.91 respectively. In this treatment T_4 was comparable with T_9 and the treatment T_3 was comparable with T_6 and T_2. But treatment T_6 is significantly higher than T_2. The lowest leaf area index was recorded in the absolute control T_1 of 0.79 respectively. In respect of LAI, among the various plant hormones tested, application of 125% RDF + Press mud at 10 t ha^{-1} + Sea weed extract (T_7) recorded higher values over control and other treatments. Higher LAI could be attributed to increase of metabolic activity in plant which could have promoted meristamatic activities causing apical growth. Hence, increase N utilization by plants in response to pressmud application have increased photosynthesis and ultimately leaf area index. This was in line with the findings of Yadav *et al.* (2009) [13].

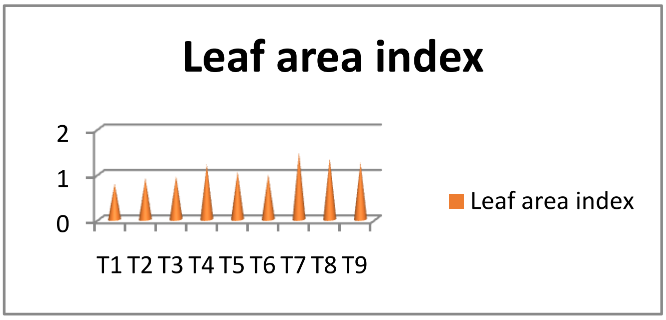

Fig.2. Leaf area index

4.3 Number of leaves

At 60 DAS the maximum number of leaves $plant^{-1}$ of 45.30 in the treatment with 125% RDF + Press mud + Sea weed extract (T_7). The treatments were followed by T_8, T_9, T_4, T_5, T_6, T_3 and T_2 registering the number of leaves $plant^{-1}$ of 43.10, 41.00, 38.00, 34.60, 32.00, 31.20 and 29.40, respectively. The treatment T_3 was on par with T_6. The lowest number of leaves $plant^{-1}$ was recorded in the absolute control T_1 of 24.00 respectively.

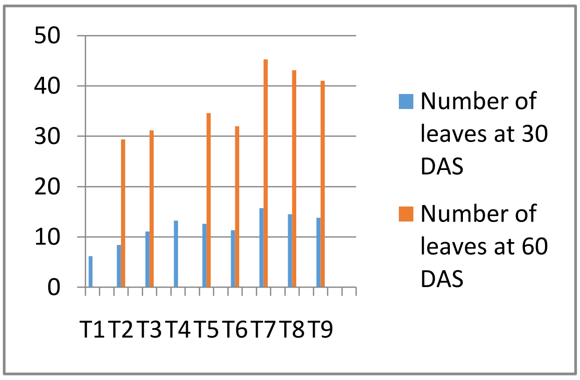

Fig.3. Number of leaves

4.4 Dry matter production

Among the various treatments, application of 125% RDF + Press mud at 10 t ha^{-1} + Sea weed extract at 5% (T_7) significantly recorded the highest dry matter production of 3816 kg ha^{-1} and was on par with the application of 125% RDF + Vermicompost at 6 t ha^{-1} + Sea weed extract at 5% (T_8). It was followed by 125% RDF + Coirpith compost at 6 t ha^{-1} + Sea weed extract at 5% (T_9) and it was comparable with 100% RDF + Press mud at 10 t ha^{-1} + Sea weed extract at 5% (T_4). The lowest dry matter production was recorded in the absolute control T_1 of 2653 kg ha^{-1} at harvest stage respectively.

Similar results was recorded in DMP values also, application of 125% RDF + Press mud at 10 t ha^{-1} + Sea weed extract (T_7) recorded higher values over control and other treatments. The higher DMP might be due to increased leaf area due to sustained and enhanced availability of nutrients from combined source of pressmud and inorganic fertilizer till the maturity that would have enhanced better biomass production.

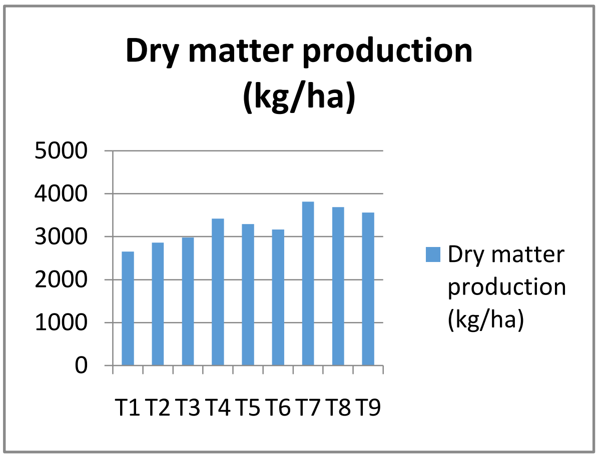

Fig.4. Dry matter production (kg/ha)

4.5 Pod yield and haulm yield

In respect of pod yield and haulm yield, among the various treatments observed, application of 125% RDF + Press mud at 10 t ha^{-1} + Sea weed extract (T_7) recorded higher values over control and other treatments. This might due to higher amount of nutrients supplied through pressmud along with inorganic fertilizer, which have increased the availability of nutrients in soil, thus more uptake of nutrients and increased photosynthetic efficiency as evident from increased LAI resulted in higher pod yield and haulm yield. This results is in accordance with the reports of Kalaiyarasan and Vaiyapuri (2008) [6]. The control plot recorded the lowest pod yield and haulm yield.

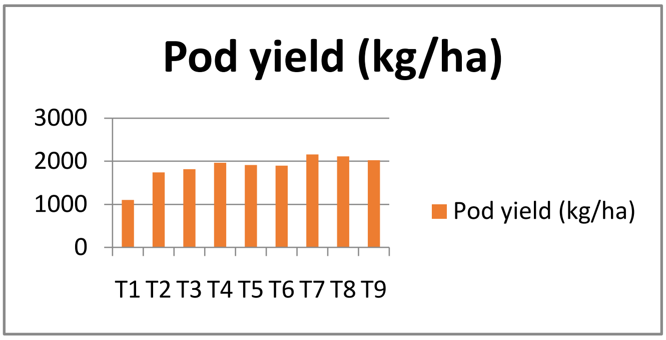

Fig.5.Pod yield (kg/ha)

4.6 Kernel yield

Application of various organics significantly influenced the kernel yield in groundnut. Kernel yield were highest under the treatment T_7 which received 125% RDF + Press mud at 10 t ha^{-1} + Sea weed extract. This was followed by T_8 125% RDF + Vermicompost at 6 t ha^{-1} + Sea weed extract. This might be due to the fact that pressmud offer a balanced nutrition to plants, providing nutrients such as N, K, exchangeable Ca, Mg and P that can be taken readily by plants (James Pitchai *et al.*, 2009) [5] and greater diversity and activity resulting in higher kernel yield (Edwards, 2004) [4]. The treatment control (T_1) registered the lowest kernel yield.

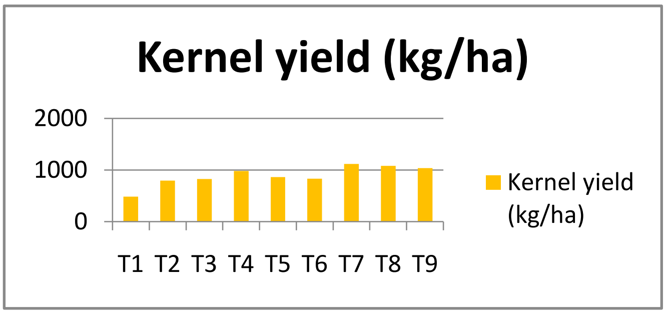

Fig.6. Kernel yield (kg/ha)

4.7 Crop nutrient uptake and post harvest soil nutrient status

Plants receiving organic sources made the greatest uptake of N, P and K because of enhancement of vegetative growth and development of a larger sink. It might be due to the greater availability of nitrogen in soil which enhance the growth of plants and lead to higher accumulation of nutrients in their parts along with the highest total uptake. The enhanced release of nitrogen from the organic sources increase nitrogen uptake by groundnut crop (Nathiya and Sanjivkumar, 2014) [7].

The control plot which recorded higher soil available NPK after harvest. This might be due to lower uptake of nutrients registered in this treatment in turn recorded higher available nutrient in soil after harvest. The least value of soil available NPK was registered in plot with 125% RDF + Press mud at 10 t ha^{-1} + Sea weed extract (T_7) which might be due to higher biomass registered in this plot.

4.8 Economics

Among the various treatements, application of 125% RDF + Vermicompost at 6 t ha^{-1} + Sea weed extract (T_8) reported maximum cost of cultivation of Rs. 47,705 but net income of Rs. 82,015 and benefit cost ratio of Rs. 2.71 was lower than T_7. Higher net income of Rs. 87,780 and benefit cost ratio of Rs. 2.88 was recorded in treatment with 125% RDF + Press mud at 10 t ha^{-1} + Sea weed extract (T_7). Due to high cost of cultivation 125% RDF + Vermicompost at 6 t ha^{-1} + Sea weed extract (T_8) it has resulted in low profit than treatment T_7. Similar result was also reported by Byareddy (2008) [2]. The least gross income of Rs. 57,960, net income of Rs. 13,115 and benefit cost ratio of Rs. 1.29 was recorded in absolute control. This was evident with poor kernel yield obtained in this treatment.

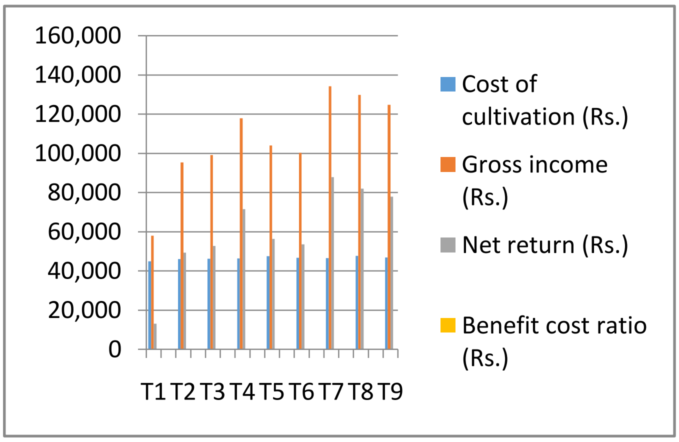

Fig.7. Economics

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