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A REVIEW :

A review on groundnut with organic manures

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SUMMARY : Groundnut is the principal edible oilseed crop of Andhra Pradesh and Telangana In addition to edible oil, some of the groundnut varieties are recommended as table purpose for human consumption because of its high nutritive value and called as table purpose varieties. Nutrient management in organically grown groundnut is possible through different organic manures without reduction in grain yield. The available literature on the effect of vermicompost, enriched vermicompost, farm yard manure and spent mushroom substrate compost on growth, yield and quality of groundnut was presented underthe relevant heads in the following pages. As the literature in organic groundnut is limited, available literature on integrated nutrient management is also added.

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KEY WORDS :
Groundnut, Vermicompost, Mushroom spent substrate

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BACKGROUND AND OBJECTIVES

Nutrient management in organically grown groundnut is possible through different organic manures without reduction in grain yield.Indiscriminate use of chemical fertilizers over years for crop production resulted in deterioration of soil quality and decline in crop yield. Use of only nitrogenous and phosphatic fertilizers, as practiced by farmers also creates nutrient imbalance in soil besides deficiency in micronutrients. Organic manures not only supply the plant nutrients but also improve soil health, the indirect effects being augmentation of beneficial microbial population and their activities in the soil for organic matter decomposition, biological nitrogen fixation and solubilisation of insoluble phosphates; while availability of plant nutrients, the direct effect, is through addition of nitrogen, phosphorus, potassium and small amounts of secondary and micronutrients such as calcium, sulphur manganese, zinc, copper and iron. Moreover, the amount of micronutrients present in organic manures may be sufficient to meet the requirement of crop production (Duhan and Mahendra, 2002). Use of organic manures in one form or the other has advantages like nutrient conservation, slow release, improvement of soil physical conditions and enhanced biological activities resulting in higher crop yields.

Growth parameters :

Initial and final plant population :

Annual report, AICRP on groundnut (2011) reported that, high plant stand at harvest was obtained with foliar application of pre treated FYM @ 7.5 t ha^{-1} with PSB, PSM

and bio pesticides + seed treatment with PSB, PSM andfoliar application of bio pesticides of neem seed kernel extract @ 5 per cent at 40 to 45 days after sowing is (1.87 lakh ha^{-1}) when compared to farmers practice is (1.83 ha^{-1}) and absolute control(1.82 lakh ha^{-1}) in sandy loam soils of Durgapura centre, West Bengal.

Gunri and Nath (2012) revealed that application of poultry manure @ 5 tonnes $ha^{-1}$and biopesticideneem cake @ 500 kg ha^{-1} + seed treatment with *Trichodermaviridi*@ 5 g kg^{-1} of seed + spraying of *Neem* seed kernel extract @ 2 per cent at 30 DASto groundnut resulted insignificantly highest plant stand at harvest when compared to application of farm yard manure @ 10 tonnes ha^{-1}.

Yogendra Kumar *et al*. (2013) revealed that application of farmyard manure @ 7.5 t ha^{-1} inoculated with microbes (PSB+PSM+pseudomonas) 15 days before sowing (heapit) followed by foliar spray of NSKE @ 5 per cent at 30 DAS resulted in significantly higher plant population(1.83 lakh ha^{-1}).

Plant height (cm) :

Karunakaran *et al.* (2010) revealed that application of 125per cent recommended dose of fertilizers (17:34:54 kg N, P_2O_5, K_2O ha^{-1}) + 5 t ha^{-1} enriched compost increased plant height (51.8 cm) than that of RDF treatment (48.3 cm) at Karaikal, Tamil Nadu in coastal deltaic alluvial soils.

Partha Sarathi and Sinha (2012) revealed that application of phosphorus as phosphocompost @ 5 t ha^{-1} produced taller plants (46.8cm) when compared to application of FYM, vermicompost and poultry manure @ 5 t ha^{-1}in sandy loam soils of West Bengal.

Vasundhara *et al.* (2012) reported that application of *Neem* cake @ 150 kg ha^{-1} as soil amendment+ *Pseudomonas fluorescens* @ 2.5 kg ha^{-1} at 30 and 45 DAS + gypsum@ 500 kg ha^{-1} as basal at 45 DAS + seed treatment with mancozeb @ 3 g kg^{-1} seed was given more plant height (27.7 cm) compared to control plant height (24.7 cm) of groundnut variety TMV-2 in sandy loam soils of Reddipalli, Anantapur.

Singh *et al*. (2014) revealed that the recommended dose of phosphorus @ 40 kg ha^{-1} as P enriched vermicompost @1.27 tonnes ha^{-1} applied by placement method significantly improved plant height (66.5cm) of groundnut variety RSB-87 in sandy soils of Rajasthan.

No. of branches plant^{-1} :

Vasundhara *et al.* (2012) reported that application of *Neem* cake @ 150 kg ha^{-1} as soil amendment+ *Pseudomonas fluorescens*@ 2.5 kg ha^{-1} at 30 and 45 DAS + gypsum@ 500 kg ha^{-1} as basal at 45 DAS + seed treatment with mancozeb @ 3 g kg^{-1} was given more number of branches (5.3 $plant^{-1}$)when compared to number of branches (4.4 $plant^{-1}$) in control for groundnut variety TMV-2 insandy loam soils of Reddipalli,Anantapur.

Gunri and Nath (2012) revealed that application of poultry manure @ 5 tonnes $ha^{-1}$and bio pesticide *Neem* cake @ 500 kg ha^{-1} + seed treatment with *Trichoderma viridi* @5 g kg^{-1}seed + spraying of *Neem* seed kernel extract @ 2 per cent at 30 DAS to groundnut resulted significantly more number of branches (6.7) at 25 DAS when compared to application of only farm yard manure @ 10 tonnes ha^{-1}.

Singh *et al.* (2014) revealed that the recommended dose of phosphorus @ 40 kg ha^{-1} as Penriched vermicompost @1.27 tonnes ha^{-1} applied by placement method significantly improved the number of branches (9.2) of groundnut variety RSB-87 in sandy soils of Rajasthan.

Dry matter production at 30, 60 and 90 DAS and at harvest :

Chaithanya Devi *et al*. (2003) reported that application of FYM @8 t ha^{-1} was given more dry matter production of groundnut variety K-134(50.1 kg ha^{-1}) at harvest followed by vermicompost @ 4 t ha^{-1}(48.2 kg ha^{-1}) when compared to control (36.3 kg ha^{-1}) in sandy loam soils of Tirupati.

Amendment of arable land with 18.5 t $ha^{-1}$of 6 to 24 months old naturally weathered spent mushroom substrate followed by recommended package of practices leads to far superior vegetative growth of plants (Ahlawat *et al*., 2006)

Kausale *et al.* (2009) revealed that dry matter $plant^{-1}$ was increased in groundnut with application of 100 per cent RDF (25:50:0 N and P_2O_5 kg ha^{-1}) along with 10 tonnes of FYM ha^{-1} and Rhizobium or PSB seed inoculation in clay soils of Navasari, Gujarat.

Leaf area at 30, 60 and 90 DAS :

ManishaBasu *et al.* (2007)revealed that application of organic manures like farm yard manure @10 t ha^{-1},

vermi compost @5 t ha^{-1}, green manure, fly Ash @10 t ha^{-1} in combination with recommended dose of fertilizers (20:40:40 kg N, P_2O_5, K_2O ha^{-1}) recorded the highest leaf area index (3.87)of groundnut variety AK 12-24 at Kharagpur.

Karmakar *et al.* (2005) revealed that application of FYM @ 10 t ha^{-1} in combination with paper factory sludge @ 0.65 t ha^{-1} along with fly ash @10 t ha^{-1} and RDF (30:60:20 kg N, P_2O_5, K_2O ha^{-1})increased the leaf area index (3.1) of groundnut variety JL-24 in acid lateritic clay loam soils of West Bengal.

Number and dry weight of root nodules at 30 and 60 DAS :

Kausale *et al.* (2009) revealed that nodule number $plant^{-1}$ was increased from 9.52 at 30 DAS to 38.31 at 60 DAS in groundnut with application of 100per centRDF (25:50:0 N and P_2O_5, kg ha^{-1} along with 10 tonnes of FYM ha^{-1} and Rhizobium or PSB seed inoculation in clay soils of Navasari, Gujarat.

Vasundhara *et al.* (2012) reported that application of *Neem* cake @ 150 kg ha^{-1} as soil amendment+ *Pseudomonas fluorescens*@ 2.5 kg ha^{-1} at 30 and 45 DAS + gypsum@ 500 kg ha^{-1} at 45 DAS + seed treatment with mancozeb @ 3 g kg^{-1}produced higher number of nodules (49.1 $plant^{-1}$)when compared to control (27.3 $plant^{-1}$) of groundnut variety TMV-2 in sandy loam soils of Reddipalli, Anantapur.

Sher Muhammad *et al.* (2014) reported that nodule number and dry weight of root nodules $plant^{-1}$ of chickpea were significantly higher with application of P enriched compost under irrigated (34.95 and 0.55 g $plant^{-1}$) and rainfed conditions (20.84 and 0.42 g $plant^{-1}$) at Rawalpindi, Pakisthan compare to control (20.67 and 0.34 g $plant^{-1}$) in irrigated system and (14.55 and 0.26 g $plant^{-1}$) in rainfed conditions in sandy loam soils.

Yield attributes and yield :

Number of pods $plant^{-1}$:

Kurmaran *et al.* (2001) revealed that application of RDF(34:17:54 kg N, P_2O_5, K_2O ha^{-1}) + FYM @ 12.5 t ha^{-1} as basal + 17 kg P_2O_5 ha^{-1} at 30 DAS produced significantly more no of pods (14.95 $plant^{-1}$) when compared to the only application of RDF(12.17 $plant^{-1}$) by groundnut variety. TMV-7 in sandy loam soils of Killikulam, Tamil Nadu.

Chaithanya Devi *et al.* (2003) reported that application of vermicompost @ 4 t ha^{-1} was given higher number of pods (18 $plant^{-1}$) followed by FYM @8 t ha^{-1}(17 $plant^{-1}$)when compared to control (12$plant^{-1}$) by groundnut variety K-134 in sandy loam soils of Tirupati.

Karunakaran *et al.* (2010) revealed that application of 125 per cent recommended dose of fertilizers (17:34:54 kg N, P_2O_5, $K_2O$$ha^{-1}$) + 5 t ha^{-1} enriched compost increased number of pods (24.7$plant^{-1}$) than the RDF applied plants (23.2$plant^{-1}$) at Karaikal, Tamil Nadu in coastal deltaic alluvial soils.

Number of kernels pod^{-1}:

Karmakar *et al.* (2005) revealed that FYM @ 10 t ha^{-1} in combination with paper factory sludge @ 0.65 t ha^{-1} along with fly ash @10 t ha^{-1} and RDF(30: 60: 20 kg N, P_2O_5, K_2O ha^{-1})increased the number of kernels (1.87pod^{-1})of groundnut variety JL-24 in acid lateritic clay loam soils of West Bengal.

Ibrahim *et al.* (2008) tested foliar spray of chicken manure, biogas manure and pigeon manure extract @ 600 L ha^{-1}at lower dose (30:30:25 N, P_2O_5, K_2O kg ha^{-1}) and higher dose (60:60:50 N, P_2O_5, K_2O kg ha^{-1}) and founded that foliar spray of pigeon manure extract increased the kernel number (1.7 and 1.6 pod^{-1}) of groundnut variety CV Gaiza-5 over the biogas (1.6 and 1.2 pod^{-1}) and chicken manure extract (1.2 and 1.5 pod^{-1}) during 2006 and 2007, respectively atGaiza, Egypt.

Karunakaran *et al.* (2010) revealed that application of 125per cent of recommended dose of fertilizers (17-34-54 kg N, P_2O_5, K_2O ha^{-1}) + 5 t ha^{-1} enriched compost was given on par number of kernels pod^{-1} (1.8) with RDF treatment (1.9) at Karaikal, Tamil Nadu in coastal deltaic alluvial soils.

Shelling percentage :

Application of FYM @ 10-15 t ha^{-1} increased the pod and haulm yields and improved the yield parameters like shelling percentage compared to the recommended dose of fertilizers (Subrahmaniyan *et al.*, 2000).

Ibrahim *et al.* (2008) tested foliar spray of chicken manure, biogas manure and pigeon manure extract @ 600 L ha^{-1}at lower dose (30:30:25 N, P_2O_5, K_2O kg ha^{-1}) and higher dose (60:60:50 N, P_2O_5, K_2O kg ha^{-1}) and found that foliar spray of pigeon manure extract increased the shelling percentage (65.8 and 6.2 %) of groundnut variety CV Gaiza-5 over the biogas (63.9 and 65.6 percentage) and chicken manure extract (61.7 and 63.7%)

during 2006 and 2007, respectively at Gaiza, Egypt.

Vasundhara *et al.* (2012) reported that application of *Neem* cake @ 150 kg ha^{-1} as soil amendment+ *Pseudomonas fluorescens*@ 2.5 kg ha^{-1} at 30 and 45 DAS + gypsum@ 500 kg ha^{-1} as basal at 45 DAS + seed treatment with mancozeb @ 3 g kg^{-1} was given more shelling percentage (73) when compared to control (64 %) in groundnut variety TMV-2 on sandy loam soils of Reddipalli, Anantapur.

100 Kernel weight :

Kurmaran *et al.* (2001) revealed that application of RDF (34:17:54 kg N, P_2O_5, K_2O ha^{-1}) + FYM @ 12.5 t ha^{-1} as basal + 17 kg P_2O_5 ha^{-1} at 30 DAS produced significantly more 100 kernel weight (30.23 g) when compared to the only application of RDF (27.60 g) in groundnut variety CV. TMV-7 on sandy loam soils of Killikulam, Tamil Nadu.

Application of 125 per cent recommended dose of fertilizers (17:34:54 kg NPK ha^{-1}) + 5 t ha^{-1} enriched compost was increased the test weightof groundnut compared to RDFon coastal deltaic alluvial soils of Karaikal, Tamil Nadu (Karunakaran *et al.*,2010)

Vasundhara *et al.* (2012) reported that application of *Neem* cake @ 150 kg ha^{-1} as soil amendment+ *Pseudomonas fluorescens*@ 2.5 kg ha^{-1} at 30 and 45 DAS + gypsum@ 500 kg ha^{-1} as basal at 45 DAS + seed treatment with mancozeb @ 3 g $kg^{-1}$was given more 100 kernel weight (37 g) when compared to control (29 g) in groundnut variety TMV-2 on sandy loam soils of Reddipalli, Anantapur.

Pod and haulm yield :

ManishaBasu *et al.* (2007)revealed that application of organic wastes like farm yard manure @10 t ha^{-1}, vermi compost @5 t ha^{-1}, green manure, fly ash @10 t ha^{-1} in combination with recommended dose of fertilizers (20:40:40 kg N, P_2O_5, K_2O ha^{-1}) recorded the highest pod yield (1465 kg ha^{-1}) of groundnut variety AK 12-24 at Kharagpur.

Zalate and Padmani (2009) revealed that application of FYM @ 6 t ha^{-1} + Rhizobium + PSM increased pod yield (2278 kg ha^{-1}) and haulm yield(3361 kg ha^{-1}) of groundnut variety GG-20 during *Kharif* 2006 in sandy loam soils of Junagadh, Gujarat.

Ersin Polat *et al.* (2009) studied the effect of spent mushroom compost @ 40 t ha^{-1} as organic matter source on cucumber in pot culture experiment and found significant effect of SMC on total yield(14.40 kg m^2)of the cucumber and also significant increase in dry matter occuredduring the whole vegetative period.

Application of farmyard manure @7.5 t ha^{-1} inoculated with microbes PSB+ PSM+ pseudomonas 15 days before sowing (heapit) and followed by foliar spray of NSKE @ 5per cent gave significantly higher pod yield (2750 kg ha^{-1}) and haulm yield (4081 kg ha^{-1}) of groundnut variety Girnar-2 in sandy loam soils of Rajasthan (Kumar *et al.*,2013).

Sarangi and Lama (2013) reported that application of vermicompost @ 6.0 t ha^{-1} prepared with 5.0per cent of lime increased the pod yield of groundnut variety JL 220 (5.08 t ha^{-1})when compared to control (2.45 t ha^{-1})in silty clay loam soils of Meghalaya during *Kharif* 2009 under rainfed situations.

Sonia *et al.* (2013) reported thatapplication of bio gas slurry enriched with mushroom spent substrate + *Trichodermaviride* was showed significantly higher pod yield (1375 kg ha^{-1}) when compared to control (830 kg ha^{-1}) in mustard crop at Patna, Bihar.

Vekariya *et al.* (2014) reported that application of FYM @ 5.0 t ha^{-1} recorded significantly higher pod yield(1821 kg ha^{-1})and haulm yield (3440 kg ha^{-1})of groundnut variety GG-20when compared to pod yield (494 kg ha^{-1}) and haulm yield (2157 kg ha^{-1})of control (no NPK) while lopping of glyricidia applied as mulch on black clay soils during rainy season, 2005-06.

Prabu *et al.* (2014) reported that pod yield of cowpea was showed significantly higher inpot culture experiment of Cowpea in red soil and sand in the ratio 2:1 supplemented with 500 g of compost prepared from mushroom spent substrate when compared to pot mixture supplemented with 250g of compost prepared from mushroom spent substrate and Pot containing mixture of red soil and sand without compost (control)at Dindigul, Tamil Nadu.

Harvest index :

Harvest indexof 0.46 was reported with application ofpre treated FYM @ 7.5 t ha^{-1} with PSB + PSM + bio pesticides + seed treatment with PSB + PSM + bio pesticides + foliar spray of *Neem* seed kernel extract @ 5per cent at 40 to 45 days after sowing when compared to farmers practice of application of pre treated FYM @ 7.5 t ha^{-1}(0.45)and absolute control (0.44) in sandy

loam soils of darwad centre (Annual report, AICRP on Groundnut, 2011).

Quality parameters :

Oil content :

Foliar spray of chicken manure, biogas manure and pigeon manure extract @ 600 L ha^{-1}at lower dose (30:30:25 N, P_2O_5, K_2O kg ha^{-1}) and higher dose (60:60:50 N, P_2O_5, K_2O kg ha^{-1}) was tested by Ibrahim *et al.* (2008) and found that foliar spray of pigeon manure extract increased the oil percentage (46.8 and 46.3) of groundnut variety CV Gaiza-5 over the biogas (38.3 and 38.0 %) and chicken manure extract (42.3 and 42.0 %) during 2006 and 2007, respectively at Gaiza, Egypt.

Annual report, AICRP on Groundnut(2011) reported that more oil content (51.3 %)with application of FYM @ 7.5 t ha^{-1} with PSB, PSM and bio pesticides + seed treatment with PSB, PSM and bio pesticides + foliar spray of *Neem* seed kernel extract @ 5 per cent at 40 to 45 days after sowing when compared to farmers practice of application of pre treated FYM @ 7.5 t ha^{-1}(50.78 %) and absolute control (47.23 %) in sandy loam soils of Durgapura centre.

Singh *et al.* (2014) revealed that the recommended dose of phosphorus @ 40 kg ha^{-1} as P enriched vermicompost @1.27 tonnes ha^{-1} applied by placement method significantly improved oil content (47.3)of groundnut variety RSB-87 in sandy soils of Rajasthan

Oil yield :

ParthaSarathi *et al.* (2011) revealed that groundnut can be organically produced with adequate supply of poultry manure @ 2.5 t ha^{-1} + *Neem* cake @ 2.5 t ha^{-1} + vermi compost @ 2.5 t ha^{-1} + phospho compost @ 2.5 t ha^{-1}. Among the organic treatments, phospho compost @ 5 t ha^{-1} recorded highest values of oil yield(667.7 kg ha^{-1}), crude protein (22.4%), soluble protein (10.5) per cent, total sugar (13.1) per cent and starch (14.8) per cent of groundnut variety TAG-24 on sandy loam soils of West Bengal.

Singh *et al.* (2014) revealed that the recommended dose of phosphorus @ 40 kg ha^{-1} as Penriched vermicompost @1.27 tonnes ha^{-1} applied by placement method significantly improved oil yield(704.2 kg ha^{-1})of groundnut variety RSB-87 in sandy soils of Rajasthan.

Nutrient content and uptake :

Nutritional properties of organic manures :

Seshadri Reddy *et al.* (2004) evaluated the nutritional composition of FYM, composted poultry manure, urban garbage compost and enriched urban garbage compost and found that NPK per cent was(0.91, 0.42, 0.74),(1.96, 2.43, 0.61),(0.86, 0.61, 0.59),(1.36, 1.50, 0.96) and (1.63, 1.20, 0.56), respectively in above organic manures.

Spent mushroom substrate normally contains 1.9:0.4:2.4 per cent NPK before weathering and 1.9:0.6:1.0 NPK after weathering) for 8-16 months. In addition spent mushroom substrate in nutrient poor soils improves its health by improving the texture, water holding capacity and nutrient status. (Ahlawat *et al.*, 2005)

Gulati and Barik (2011) reported that paddy straw mushroom spent substrate has pH in the range of 8.82 to 9.16 while oyster mushroom spent substrate has pH between 6.51 to 7.69. The oyster mushroom spent mushroom substrate contains higher nitrogen (1.82 %) as compared to paddy straw mushroom spent (1.06 to 46 %).

Tajbakhsh *et al.* (2008) revealed that after transformation of spent mushroom substrate into vermicompost reduced pH (8), electrical conductivity (41), C: N ratio (56) and increased and total organic carbon (35), K (68), Na (10) per cent compared to those of the initial substrate.

Effect of organic manures on nutrient uptake (N, P, K, Ca and S) :

Jagdev Singh and Singh (2000) reported that application of FYM combined with NPK improvedthe soil environment, which encouraged proliferous root system resulted in better absorption of water andnutrients from lower layers resulted in higher yield and nutrient uptake.

Sailajakumari and Ushakumari (2002) reported that application of vermicompost enriched with rock phosphate @ 20 t ha^{-1} was showed significantly higher nutrient uptake in cowpea (79, 12, 34, and 26 kg NPK and Ca ha^{-1}) when compared to control (40, 4.5, 18.4, and 11 kg NPK and Ca ha^{-1}) at Trivandrum in sandy loam soils.

Seshadri Reddy *et al.* (2004) evaluated the effect of composted poultry manure, sewage sludge, enriched urban garbage compost and application of 25:75:40 kg

N, P_2O_5 and K_2O + 10 t FYM ha^{-1} recorded higher (N 110.7 kg ha^{-1}), (P 32.2 kg ha^{-1}), (K 74.3kg ha^{-1}) uptake of groundnut variety TMV-2 Regional agricultural research station, Bangalore during *Summer* season2003.

Mathukia *et al*. (2014) revealed that application of enriched vermi compost @ 5 t ha^{-1} to groundnut along with recommended dose of fertilizer (12.5:25:0 kg N, P_2O_5, K_2O ha^{-1})proved superior in uptake nutrient(N 84.72, P 5.49 and K 25.76 kg ha^{-1})of groundnut variety GG-11 during *Kharif*, 2009 onclayey soils of Junagadh.

Physical, physico-chemical,and chemical properties of soil at harvest :

Akbari *et al*. (2002) revealed that application of FYM increased the availability of potassium to crop and might have restored soil from potassium depletion, exhibit positive potassium balance and maximum P fixation.

Balaguravaiah *et al.* (2005) revealed that long-term application of FYM @ 4 t ha^{-1} improved the soil physico chemical properties of soil *i.e.* pH (7.6), EC (0.097dsm^{-1}), OC (2.5 gkg^{-1}soil)and available (120,18,188kg NPK ha^{-1})when compared to application of recommended dose of P fertilizer (17.5 kg ha^{-1}), pH (6.9), EC (0.038 dsm^{-1}), OC (1.9 gkg^{-1}soil)and available (112,14, 103 kg NPK ha^{-1})in red sandy loam soils of Ananthapur.

Elayaraja and Singaravel (2011) revealed that application of 175 per cent RDF + composted coir pith was showed better physico chemical properties and nutrient availability of soil at harvest in groundnut (pH 7.8, EC 7.8 ds m^{-1}, 0.61 per cent OC), (79.6, 8.2, 107 NPK kg ha^{-1}) when compared to 75 per cent RDF alone (pH 8.24, EC 1.47ds m^{-1}, 0.31 % OC), (54, 3.9, 87.3 NPK kg ha^{-1}) in sandy loam soils at Chennai.

Matiullakhan and Sharif (2012) revealed that nutrient availability was significantly higher with application of poultry litter + rock phosphate + effective micro organisms (0.9, 1.6 % P_2O_5), (1.2, 1.4 % N) at 45 and 120 days after incubation when compared to control (0.23, 0.3 % P_2O_5), (1.4, 1.5 % N) at 45 and 120 days at Islamabad, Pakistan.

Water studies with organic manures :

Available soil moisture :

Sarangi and Lama (2013) reported that application of vermicompost @ 6.0 t ha^{-1} prepared with 5.0 per cent of lime improved the moisture content in 0-15 cm layer by 3.06 per cent over the control in silty clay loam soils of Meghalaya.

Vekariya *et al.* (2014) reported that application of FYM @ 5.0 t ha^{-1} recorded significantly higher soil moisture content 34.64 per cent when compared to control (33.04 %)where lopping of glyricidiawere applied as mulch in black clay soils during rainy season, 2005-06.

Evapotranspiration of crop (ET_C) as influenced by organic manures :

Idinoba *et al.* (2008) revealed that the groundnut crop was grown in and outside a drainage lysimeter for two years. Mean total water used (Evapotranspiration) by the crop during the 105 days from sowing to harvest was 302.5 mm. More water was used between the vegetative and reproductive growth stages of the crop that is in between 20 and 60 days after planting. There was high positive correlation (p = 0.01) between growth parameters and water use.

Kavita *et al.* (2008) revealed that appreciable amount of rainfall begins from 24th week and ends to 43rd week *i.e.* total 20 weeks receiving appreciable rainfall. Highest weekly rainfall was found to be 110.8 mm during the 33rd weekAnnual reference evapotranspiration values at 70 per cent probability levels was worked out to be 1960 mm. Annual crop evapotranspiration was found to be 395 mm in sandy loam soils.

Economics with organic manures :

Kumar *et al.* (2013) revealed that application of farmyard manure @7.5 t ha^{-1} inoculated with microbes PSB+ PSM+ pseudomonas 15 days before sowing (heapit) and followed by foliar spray of NSKE @ 5 per cent at 30 DAS gave significantly higher B:C ratio (Rs. 3.66) and net returns (Rs. 64371 ha^{-1})of groundnut variety Girnar-2 in sandy loam soils of Rajasthan.

Mathukia *et al.* (2014) revealed that application of enriched vermi compost @ 5 t ha^{-1} to groundnut along with recommended dose of fertilizer (12.5:25:0 kg N, P_2O_5, K_2O ha^{-1})proved superior in respect of B:C ratio (Rs. 2.8)and net returns (Rs. 35490 ha^{-1})of groundnut variety GG-11 during *Kharif*, 2009 on clayey soils of Junagadh.

Conclusion :

Growth, yield, yield attributes, nutrient uptake, soil properties, crop ET, net returns of organic groundnut was

significantly higher with application of 100 per cent RDN (30 kg ha^{-1}) through P enriched vermicompost and vermicompost prepared from mushroom spent substrate.Nutrient composition of vermicompostenriched with rock phosphosphate and mushroom spent substrate based vermicompost was higher and identified as alternate sources of organic manures in organic cultivation of groundnut in addition to FYM and vermicompost for organic groundnut.

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