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Full Research Article

Soil Application Multi Micro Nutrient Fertilizer Mixtures (MMM) Influenced in Groundnut Yield

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Abstract

A field experiment was conducted with a RBD with three replicates having Sixteen treatments of Soil application of 20, 40 and 60 kg ha^{-1} of Zinc High, Easy Mix, Vasundhara, Multinelf 16 and Boracal 12 multi-micronutrient mixtures (MMM) for Groundnut to ascertain the best matching mixture for maximum yield enhancement during summer 2011–12, 2012–13 and 2013−14 at Oilseeds Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India. The Recommended Dose of fertilizer i.e. 25:50:0 NPK kg ha^{-1} was used. Nitrogen @ 25 kg ha^{-1} and Phosphorus @ 50 kg ha^{-1} were applied as basal dose and doses of multi-micronutrient fertilizer was given at sowing. Pooled results revealed that treatment (T_{15}) i.e. Mixture of Zinc, Ferrous iron, Boron, calcium and magnesium (Multinelf 16) @ 60 kg ha^{-1} recorded significantly higher pod yield (3284 kg ha^{-1}) over remaining treatments excluding Easy mix (3145 kg ha^{-1}), Zinc High (3059 kg ha^{-1}), Vasundhara (3018 kg ha^{-1}) and Boracal (2803 kg ha^{-1}) @ 60 kg ha^{-1} over its higher and lower level at the time of basal application. However, 100-kernal weight influenced significantly due to application of different Multi-micronutrient fertilizers mixture. Similarly, fetched significantly higher net return (₹ 96492 ha^{-1}) and B:C ratio 3.18 followed by Easy mix @ 60 kg ha^{-1} (₹ 1 92377 ha^{-1}, 3.12), Zinc High @ 60 kg ha^{-1} (₹ 88259 ha^{-1}, 3.00) Vasundhara @ 60 kg ha^{-1} (₹ 85233 ha^{-1}, 2.95) and Boracal 12 @ 60 kg ha^{-1} (₹ 77883 ha^{-1}, 2.81) over left other treatments.

1. Introduction

Groundnut (*Arachis hypogaea* L.) is a species in the legume family (*Fabaceae*) is originated in the Northwest Argentina region in South America and is presently cultivated in 108 countries of the world. Asia with 63.4% area produces 71.7% of world groundnut production followed by Africa. In India, it is cultivated on 4.76 mha with a production of 4.74 mt and a productivity of 996 kg ha^{-1}. India ranks second in the world groundnut production (Anonymous, 2013). Groundnut is also known as earthnuts, Peanuts, jack nuts, g-nuts, and monkey nuts. Groundnut is grown mainly in *kharif* and summer season in India. Groundnut (*Arachis hypogaea* L.) is a major oilseed crop in Maharashtra, India is the world's largest producer of groundnut where nutritional disorders cause yield reduction from 30−70% depending upon the soil types. In spite of recommended application of fertilizer (NPK-nitrogen, phosphorus, potassium) the yield does not reach the national target as the soils of Maharashtra are moderately black to brown having low nutrient status. Intensive cropping leads to deficiency of secondary and micronutrients, which is the main constraint for low yield of groundnut. A balanced fertilizer application based on soil tests. Nutrient availability depends on soil pH, organic matter content and rates of released of nutrients from the soil minerals. The availability of other essentional ions such zin, boron iron, manganese, copper may be low in alkaline soils (pH≥8.5) while an acid soil (pH≤6.0) may be deficiency in molybdenum and manganese. (Badole et al., 2003) Therefore, depending of soil nutrient status to increasing yield of groundnut and can be corrected by soil application of these nutrients. Under such conditions, multi micro nutrient mixture fertilizer plays an important role in groundnut and enhances the groundnut yield substantially. Looking to the above facts the experiment is planned to studies on "Effect of soil application multi micro nutrient mixture fertilizer in groundnut (*Arachis hypogaea* L.)" was initiated at Oilseeds Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, 444 104, Maharashtra, India.

2. Materials and Methods

A field experiment was designed in Randomized Block Design

with replicated thrice in Sixteen treatments of Soil application 20, 40 and 60 kg ha^{-1} Multi micro nutrient fertilizer mixture (MMM) in Groundnut. The experiment was conducted during Summer 2011−12, 2012−13 and 2013−14 at Oilseeds Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India. Soil of experimental site was clay loam in texture, low in available nitrogen (142.28 kg ha^{-1}), medium in available phosphorus (12.10 kg ha^{-1}), fairly rich in potassium (260 kg ha^{-1}) and low to critical limit in Zinc (0.5 mg kg $^{-1}$ soil), Ferrous iron (4.4 mg kg^{-1} soil), Boron (0.8 mg kg^{-1} soil), sulphur (9.8 mg kg^{-1} soil) and magnesium (1.89 mg kg^{-1} soil) micro nutrients. The soil was slightly alkaline in reaction pH (8.10) and electrical conductivity (0.12 dsm^{-1}). It was low in organic carbon (0.46%). Treatments are T_1: Control, T_2: Soil application zinc high @ 20 kg ha^{-1}, T_3: Easy mix @ 20 kg ha^{-1}, T_4: Vasundhara @ 20 kg ha^{-1}, T_5: Multinelf 16 @ 20 kg ha^{-1}, T_6: application Boracal 12 @ 20 kg ha^{-1}, T_7: Soil application zinc high @ 40 kg ha^{-1}, T_8: Easy mix @ 40 kg ha^{-1}, T_9: Vasundhara @ 40 kg ha^{-1}, T_{10}: Multinelf 16 @ 40 kg ha^{-1}, T_{11}: application Boracal 12 @ 40 kg ha^{-1}, T_{12}: Soil application Zinc High @ 60 kg ha^{-1}, T_{13}: Easy mix @ 60 kg ha^{-1}, T_{14}: Vasundhara @ 60 kg ha^{-1}, T_{15}: Multinelf 16 @ 60 kg ha^{-1}, T_{16}: application Boracal 12 @ 60 kg ha^{-1} application of micronutrient at the time of basal dose with major nutrients. The gross and net plot sizes were 3.60×3.0 m^2 and 3.0×2.80 m^2 respectively. The crop variety TAG 24 was sown at 30×10 cm^2. The Recommended Dose of fertilizer i.e. 25:50:0 N.P.K kg ha^{-1} was used. Nitrogen @ 25 kg ha^{-1} and Phosphorus @ 50 kg ha^{-1} were applied as basal dose and doses of multi micro nutrient fertilizer was given at sowing. Accordingly urea (46% N) and SSP (16% P_2O_5) were used.

3. Results and Discussion

Pooled results revealed that treatment (T_{15}) i.e. Mixture of Zinc, Ferrous iron, Boron, calcium and magnesium (Multinelf 16) @ 60 kg ha^{-1} recorded significantly higher pod yield (3284 kg ha^{-1}) over remaining treatments excluding easy mix (3145 kg ha^{-1}), zinc high (3059 kg ha^{-1}), Vasundhara (3018 kg ha^{-1}) and Boracal (2803 kg ha^{-1}) @ 60 kg ha^{-1} over its higher and lower level at the time of basal application presented in Table 1. The higher yield with Multinelf 16 (MMM) @ 60 kg ha^{-1} was mainly due to higher plant biomass, branches plant^{-1}, pods plant^{-1}, dry pod weight and harvest index over other treatments. However, 100-kernal weight influenced significantly due to application of different multi micronutrient fertilizers mixture. The data on 100 kernels weight showed that 100 kernels weight was significantly affected by various treatments. The treatment (T_{15}) i.e. Mixture of Zinc, Ferrous iron, Boron, calcium and magnesium (Multinelf 16) @ 60 kg ha^{-1}.

Was recorded maximum 100 kernels weight (45.18 g). However, it was at par with Easy mix (44.49 g), Zinc High (44.74 g), Vasundhara (44.60 g) and Boracal (44.95 g) @ 60 kg ha^{-1} and recorded significantly maximum 100 kernels weight over the treatments. The treatment T_1 control recorded the lowest 100 kernels weight plant^{-1} (42.34 g). It might be due to efficient pod filling by better translocation of photosynthesis by application of FYM, recommended dose of fertilizer and water soluble grade fertilizer resulted in improved the weight 100 seeds. Similar results were also reported by Chandrasekaran et al. (2008); Elayaraja et al. (2012); Kumaran, (2000); Nayak et al. (2009). Similarly, fetched significantly higher net return (₹ 96492 ha^{-1}) and B:C ratio 3.18 followed by Easy mix @ kg ha^{-1} (₹ 92377 ha^{-1}, 3.12), zinc high @ 60 kg ha^{-1} (₹ 88259 ha^{-1}, 3.00) Vasundhara @ 60 kg ha^{-1} (₹ 85233 ha^{-1}, 2.95) and Boracal 12 @ 60 kg ha^{-1} (₹ 77883 ha^{-1}, 2.81) over left other treatments. Hence for getting maximum economic return from summer groundnut basal application Multinelf 16 i.e. Mixture of zinc, Ferrous iron, boron, calcium and magnesium @ 60 kg ha^{-1} is found to be Profitable through improvement of productivity. The positive response of micronutrients with recommended NPK can be attributed to the availability of sufficient amount of plant nutrients throughout the growth period, resulting in better uptake and yield advantage. Similar effect of combined application of Zn and B was observed by Singarvel et al. (2006). Thorave, D.S., M.B. Dhonde, (2007) observed that, mean number of nodules increased from 30 to 90 DAS and decline thereafter. Maximum numbers of nodules were recorded at 90 days after sowing. The mean numbers of root nodules at 90 DAS were (37.32). Sahu et al. (1998) reported that groundnut significantly responded to Mo application, producing 32.1% higher yield than recommended NPK dose. Soil application of Zn+B+Mo registered the highest net return (₹ 11010 ha^{-1}) and increased the benefit-cost ratio. So NPK fertilizer along with soil application of Zn, B and Mo is required to increase the productivity of groundnut. Revaithi et al. (1996); Munda et al. (2004); Subrahmaniyan et al. (2000) reported that combined application of Zn, Fe, Cu, Mn, Ca, and Mg increased the pod and haulm yield of groundnut. Micronutrient application which might be due to involvement of boron in catalyzing the metabolism of carbohydarates and Fe and Zn increases enzyme activity and other biological oxidation reactions. The soil being deficient in N, P, Fe and Zn, it is appropriate that the crop had responded to the fertilizer and micronutrients application. Earlier reports also say that the black calcareous soils of the command are highly deficient in Fe and Zn (Vijashekhar et al., 2000) and similar observed Patil et al. (2003) significant increase in groundnut yield by soil application of Fe and Zn along with RDF in black soils of north Karnataka. Application of micronutrients successfully prevented occurrence of chlorosis and increased chlorophyll content, pod yield and micronutrient uptake. The two years of experimentation

Table 1: Pooled growth and yield attributes as influenced by various treatments (2012–2014)

Treatments	Plant height (cm)	No. of branches plant^{-1} at harvest	Total No. of pods plant^{-1} at harvest	Dry pod yield (kg ha^{-1})	Dry haulm yield (Kg ha^{-1})	Kernel yield (kg ha^{-1})	100-Kernel weight (g)	Gross returns (₹ ha^{-1})	Net returns (₹ ha^{-1})	B:C ratio
T_1: Control	12.87	5.42	18.04	2187	3066	1469	42.34	91594	51047	2.26
T_2: Zinc High @ 20 kg ha^{-1}	13.05	7.60	22.50	2368	3361	1634	44.39	99288	57756	2.38
T_3: Easy mix @ 20 kg ha^{-1}	13.72	6.60	20.37	2453	3589	1713	44.24	103088	61820	2.48
T_4: Vasundhara @ 20 kg ha^{-1}	13.04	5.87	20.20	2375	3272	1638	44.89	99393	56702	2.35
T_5: Multinelf 16 @ 20 kg ha^{-1}	13.89	5.65	19.00	2573	3731	1776	45.59	108102	66048	2.57
T_6: Boracal 12 @ 20 kg ha^{-1}	13.27	6.87	19.98	2444	3430	1682	43.27	102448	60374	2.44
T_7: Zinc High @ 40 kg ha^{-1}	14.47	6.77	21.65	2767	4179	1923	45.04	116392	75299	2.75
T_8: Easy mix @ 40 kg ha^{-1}	14.32	6.97	21.67	2820	3945	1936	43.94	118155	75031	2.76
T_9: Vasundhara @ 40 Kg ha^{-1}	14.19	6.47	21.05	2793	3906	1932	43.00	117198	75122	2.76
T_{10}: Multinelf,16 @ 40 kg ha^{-1}	14.52	6.33	21.12	2927	4061	2040	43.39	122996	79844	2.85
T_{11}: Boracal 12 @ 40 kg ha^{-1}	14.42	6.67	20.54	2803	4190	1939	43.87	117891	77883	2.81
T_{12}: Zinc, High @ 60 Kg ha^{-1}	14.87	6.77	20.80	3059	4637	2118	44.74	128907	88259	3.00
T_{13}: Easy, mix @ 60 kg ha^{-1}	15.02	6.35	20.30	3145	4282	2125	44.49	132800	92377	3.12
T_{14}: Vasundhara @ 60 Kg ha^{-1}	14.79	6.60	22.33	3018	4483	2082	44.60	126961	85233	2.95
T_{15}: Multinelf 16 @ 60 kg ha^{-1}	15.37	6.20	23.37	3284	4825	2271	45.18	138596	96492	3.18
T_{16}: Boracal 12 @ 60 kg ha^{-1}	15.05	6.47	22.00	3106	4695	2080	44.95	131117	91347	3.08
Mean	14.18	6.48	20.93	2757	3978	1897	44.18	180308	74415	2.73
SEm±	0.76	0.51	2.22	166	287	111.51	0.09	6679		
CD (p=0.05)	2.29	1.54	6.65	500	863	334.32	0.29	20026		
CV (%)	9.32	15.22	14.65	8.90	10.58	8.57	9.42	8.91		

showed that application of macro-as well as micro-nutrients caused increase in pod yield by 50% of which 18% could be ascribed to the micronutrients. Hence for maximum realization of yield potential of the crop, in calcareous soils, application of micronutrients may be incorporated in the package of practices for cultivation of groundnut.

4. Conclusion

It was concluded that basal application of multi micronutrient fertilizer mixture, Multinelf 16 i.e. Mixture of Zinc, Ferrous iron, Boron, calcium and magnesium @ 60 kg ha^{-1} recorded, highest dry pods yield and getting maximum economic return

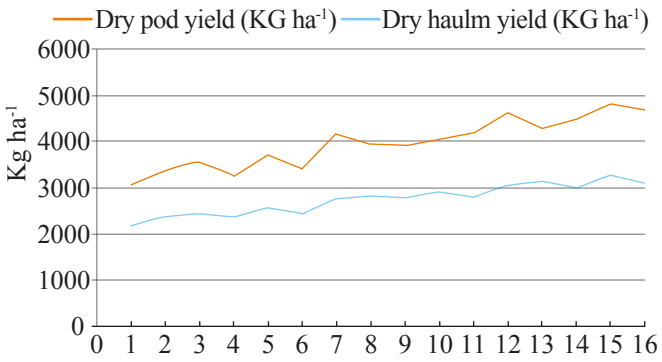

Figure 1: Dry pod yield and Dry haulm yield (KG ha^{-1}) influenced by different treatments

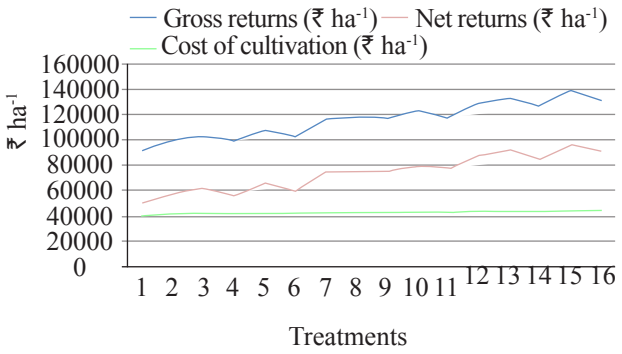

Figure 2: GMR, COC and NMR (₹ ha^{-1}) influenced by different treatments

from summer groundnut.

5. Further Research

The deficiency is specific to the element and can be prevented or corrected only by supplying that element or other optional element.

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