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The soil fertility status influenced by integrated nutrient management under kawach beej

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Abstract
The experiment was conducted during 2016-17 at Nagarjun medicinal plants garden Akola, Dr. PDKV, Akola. The experiment was laid out in Randomized Block Design with nine treatments replicated three times. The integrated nutrient management influenced the soil fertility status under kawach beej.
Based on the observations as defined in programme of research work significantly higher organic carbon (6.63 g kg^{-1}), available N (190.56 kg ha^{-1}), P (28.56 kg ha^{-1}) and K (342.70 kg ha^{-1}) were recorded with 5 t FYM ha^{-1} + N:P @ 25.0 : 50 kg ha^{-1} followed by 5 t FYM ha^{-1} with N:P @ 12.5: 25.0 kg ha^{-1}. The maximum availability of micronutrients viz., Fe (4.96 mg kg^{-1}), Mn(3.04 mg kg^{-1}), Zn (0.73 mg kg^{-1}) and Cu (2.39 mg kg^{-1}) were recorded with 5 t FYM ha^{-1} + N:P @ 25.0 : 50 kg ha^{-1} followed by 5 t FYM ha^{-1}+N:P @ 12.5: 25.0 kg ha^{-1}. Similarly use of 5 t FYM ha^{-1} with N: P @ 25.0: 50 kg ha^{-1} recorded higher microbial biomass carbon (185.19 mg kg^{-1}) as compared to other treatments indicating the importance of organics for enriching soil quality. The use of organics *viz.*, FYM with chemical fertilizers (N and P) resulted improvement in chemical and biological properties which ultimately helps in soil health and crop productivity. The results revealed that the integrated nutrient management not only improved the soil properties like pH, EC, calcium carbonate and organic carbon but also improved the soil fertility.

Keywords: Cover crop, Kawach beej, Inceptisols, Farm yard manure.

Introduction
Medicinal plants play an important role in the development of potent therapeutic agents. Herbal drugs form the backbone of the invaluable traditional medicinal practices. Recently interest in medicinal plant research has increased all over the world. It has been reported that medicinal plants used in various traditional systems have immune potential against various diseases.

Kawach beej is a green manure cover crop widely promoted as a means to reverse or slow negative effect of land use intensification. Its high herbage yield is an indication of good mulch for soil and possibly forages for livestock, depending on its palatability. Therefore, when incorporated into the soil as green manure, these cover crops can substantially improves the soil fertility. Moreover, the narrow C: N ratio facilitates their rapid decomposition to provide available nutrients to the crops.

Chemical fertilizers have played a significant role in Indian agriculture facilitating green revolution and making the country self-reliant in crop production. However, concentrated and continuous use of chemical fertilizers deteriorate the soil health, leading to acidification, micro nutrient depletion, soil degradation, reduction in the activity of soil micro flora and fauna, poor crop health and lower crop yields and quality. Besides, use of fertilizers may contribute to environmental risks like increase in global temperature, ground and surface water pollution, etc. In view of this, the integrated nutrient management offers scope to mitigate the above problems especially to medium and large farmers who can create their own organic manurial resources or do recycling of farm waste. Recent years, a concept of integrated nutrient supply involving use of organic manures and inorganic fertilizers has been developed to obtain sustained agricultural production (Gaikwad and Puranik, 1996).

Integrated nutrient management involves the judicious mixture of organic, inorganic manures along with fertilizers which maintains soil fertility, productivity. It maintains the soil fertility to an optimum level for crop productivity to obtain the maximum benefit from all possible sources of plant nutrients organics as well as inorganics in an integrated manner (Aulakh and Grant 2010). INM is also important for marginal farmers who cannot afford to supply crop nutrients through costly chemical fertilizers. In context of integrated nutrient management, organic manures are capable of supplying plant nutrients and improving soil physical environment having no definite chemical composition with low analytical value produced from animal, plant and other organic waste and by products. There are several indigenously available sources of nutrients of organic origin, in which FYM is widely used as organic manure but the availability of FYM is not adequate so, it becomes necessity of present day situation to look forward for another organic manurial source.

Material and Methods

An experiment conducted during the *kharif*2016-17, to find out the "The soil fertility status influenced by integrated nutrient management under kawach beej" The experiment was conducted at Nagarjun medicinal plants garden Akola, Dr. PDKV, Akola. The experiment was laid out in Randomized Block Design with nine treatments replicated three times. The experimental site was black belongs to Inception. The organic carbon, nitrogen, phosphorous and potash content of the soil was6.63kg ha^{-1}, 190.56 kg ha^{-1}, 28.56 kg ha^{-1}, 342.70 kg ha^{-1} respectively. The Local variety of kawachbeej was used. The seed rate (30 kg ha^{-1}) and fertilizer dose was applied treatment wise for kawachbeej crop. The seed rate was calculated on the area basis and seeds sown simultaneously in dibbling method. treatment T_1 was unfertilizer control, T_2 and T_3 dose of FYM @ 2.5 t ha^{-1}, 5 t ha^{-1} respectively was applied and in treatment $T_{4,}$ T_5 N: P 12.5: 25 kg ha^{-1}, 25: 50 kg ha^{-1} through inorganic chemical fertilizers and in treatment $T_{6,}$ $T_{7,}$ T_8 andT_9 where combination of T_2 and T_4, T_2 and $T_{5,}$ T3 and T_4, T3 and T_5 respectively. The soil and plant samples were collected and analyzed for their different properties and the observation on fertility status of soil were recorded.

Result and Discussion

From Table 1. it is revealed that, the available NPK (kg ha^{-1}), micronutrients (mg kg^{-1}), organic carbon(kg ha^{-1}) and SMBC (mg kg^{-1}) affected significantly due to different treatments. Available N was recorded significantly more in treatment (T_9) which received 5 t FYM ha^{-1} + N:P @ 25.0 : 50 kg ha^{-1} and it was at par with all the treatments except 2.5 t FYM ha^{-1} +N:P @ 12.5: 25 kg ha^{-1} (T_6), N:P @ 12.5: 25 kg ha^{-1}(T_4) and control (T_1) and available phosphorous was

Table 1: Available NPK, Micronutrients, Organic Carbon and SMBC in soils influenced by different treatments under kawach beej

Treatments	Available (kg ha^{-1})			Available micronutrients (mg kg^{-1})				Organic carbon	SMBC
	N	P	K	Fe	Mn	Zn	Cu	(kg ha^{-1})	(mg kg^{-1})
T_1–Control	160.80	19.12	312.80	4.71	2.81	0.61	2.22	6.21	134.48
T_2 -FYM @ 2.5 t ha^{-1}	181.42	22.29	335.23	4.74	2.83	0.65	2.28	6.39	150.25
T_3 -FYM @ 5t ha^{-1}	182.12	23.05	327.77	4.81	2.99	0.68	2.32	6.58	170.56
T_4 -N:P @ 12.5 : 25 kg ha^{-1}	168.48	23.69	338.71	4.73	2.84	0.62	2.24	6.36	149.96
T_5 -N:P @ 25.0 : 50 kg ha^{-1}	177.88	24.40	334.98	4.75	2.86	0.64	2.26	6.39	162.12
T_6 -FYM @ 2.5 t ha^{-1} + N:P@ 12.5 : 25 kg ha^{-1}	170.92	26.44	323.56	4.85	2.91	0.69	2.31	6.48	169.66
T_7 -FYM @ 2.5 t ha^{-1} + N:P@ 25.0 : 50 kg ha^{-1}	175.84	26.43	338.93	4.87	2.94	0.70	2.33	6.52	173.98
T_8 -FYM @ 5 t ha^{-1} + N:P@ 12.5 : 25 kg ha^{-1}	187.19	27.79	338.97	4.93	3.01	0.71	2.37	6.58	180.81
T_9 -FYM @ 5 t ha^{-1} + N:P@ 25.0 : 50 kg ha^{-1}	190.56	28.56	342.70	4.96	3.04	0.73	2.39	6.63	185.19
SE (m)±	4.91	0.64	4.06	0.06	0.05	0.02	0.03	0.07	5.20
CD (P=0.05)	14.72	1.91	12.16	0.17	0.16	0.06	0.10	0.21	15.60

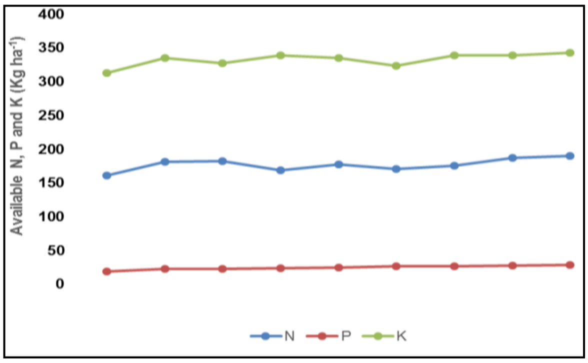

Fig 1: Effect of integrated nutrient management on avail. N, P, K (kg ha^{-1})

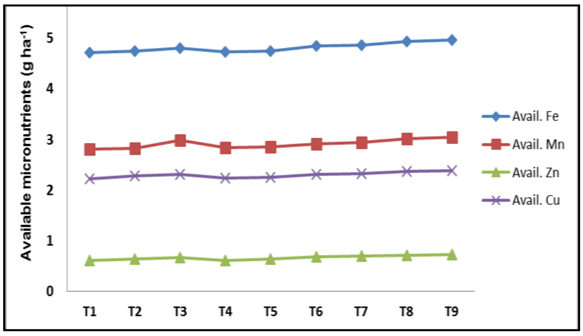

Fig 2: Effect of integrated nutrient management on available micronutrients (mg kg^{-1})

increased in treatment T_9 (28.56 kg ha^{-1}) with application of 5 t FYM ha^{-1} + N:P @ 25.0 : 50 kg ha^{-1} and it was followed by treatments 5 t FYM ha^{-1}+N:P @ 12.5: 25.0 kg ha^{-1}(T_8), 2.5 t FYM ha^{-1}+N:P @ 25: 50 kg ha^{-1}(T_7) and 2.5 t FYM ha^{-1}+N:P @ 12.5: 25.0 kg ha^{-1}(T_6). These treatments were statistically at par with each other. The available potassium was highest in T_9 (342.70 kg ha^{-1}) with the application of 5 t FYM ha^{-1} + N: P @ 25.0: 50 kg ha^{-1} and it was at par with all the treatments except T_6 (2.5 t FYM ha^{-1}+N: P @ 12.5: 25 kg ha^{-1}), T_3 (5 t FYM ha^{-1}) and T_1 (control). However, treatment T_1 where unfertilized control showed significantly lowest NPK (160.80, 19.12 and 312.80 kg ha^{-1} respectively) Similar result also reported by Sonune *et al*. (2003) and Deshmukh *et al*. (2012).

The available micronutrients (Fe, Mn, Zn and Cu) was significantly highest with the application of 5 t FYM ha^{-1}+N:P @ 25: 50 kg ha^{-1}(T_9) which was at par with the treatments 5 t FYM ha^{-1}(T_3), 2.5 t FYM ha^{-1}+N:P @ 12.5: 25 kg ha^{-1}(T_6), 2.5 t FYM ha^{-1}+N:P @ 25: 50 kg ha^{-1}(T_7) and 5 t FYM ha^{-1} +N:P @ 12.5: 25 kg ha^{-1}(T_8). The reason for increased micronutrients availability could be and enhanced microbial activity in the soil and consequent release of complex organic substances which acts as (chelating agents), which could have prevented micronutrient precipitation, fixation, oxidation and leaching. The results are line with Bellaki *et al*. (1998), Guled *et al*. (2002) and Gharpinde *et al*. (2015).

The organic carbon (kg ha^{-1}) was significantly maximum in treatment T9 with 5 t FYM ha-1 + N:P @ 25.0 : 50 kg ha-1 and at par with the application of 5 t FYM ha^{-1}(T_3), 2.5 t FYM ha^{-1}+N:P @ 12.5: 25 kg ha^{-1} (T_6), 2.5 t FYM ha^{-1}+N:P @ 25: 50 kg ha^{-1}(T_7) and 5 t FYM ha^{-1}+N:P @ 12.5: 25 kg ha^{-1}(T_8).The direct incorporation of organic manure encourages the proliferation in soil microbial environment which might have resulted in the increased organic carbon content. These findings are in agreement with the observation of (Bhriguvanshi, 1988).

The soil microbial biomass carbon was significantly highest with the application of 5 t FYM ha^{-1}+N:P @ 25: 50 kg ha^{-1}(T_9) which was at par with treatment 5 t FYM ha^{-1}(T_3), 2.5 t FYM ha^{-1}+N:P @ 12.5: 25 kg ha^{-1} (T_6), 2.5 t FYM ha^{-1}+N:P @ 25: 50 kg ha^{-1}(T_7) and 5 t FYM ha^{-1}+N:P @ 12.5: 25 kg ha^{-1} (T_8).It might be due to the supply of additional mineralizable and readily hydrolyzable carbon due to organic manure application resulted in higher microbial activity and in turn higher MBC content. Finding of Gogoi *et al*. (2010) and Nagar *et al*. (2016).

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