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Effect of Integrated Plant Nutrient Supply System on Post-harvest Soil Properties of Ambrette

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ABSTRACT

The field investigation was undertaken during *Kharif* season, 2018 to study the effect of integrated plant nutrient supply system on post-harvest soil physical, chemical and biological properties with ambrette crop (*Abelmoschus moschatus* Medic.). The experiment was laid out in RBD with eight treatments and replicated thrice. The recommended dose of fertilizers for ambrette was 120:30: 40 kg N: P_2O_5:K_2O ha^{-1}. As per the treatment schedule neem coated urea (NCU), enriched pressmud compost (EPMC) and sea weed extract (SWE) were applied to the respective plot. Ambrette crop was grown to maturity with recommended cultural practices. After harvesting, the post-harvest soil samples were collected, processed and analyzed for their physical, chemical and biological properties. The results revealed that combined application of 75% RDF- N(NCU) + P(EMPC) + SWE (T_8) registered the bulk density and pore space of 1.37 Mg m^{-3} and 50.62%, respectively. The same treatment significantly influenced WHC, pH, EC, OC, CEC, available N, P and K in the post-harvest soil. Application of 75% RDF- N(NCU) + P(EMPC) + SWE (T_8) also registered the highest bacterial population (65.82CFU × 10^{-6}), fungal population (16.46CFU × 10^{-4}) and actinomycetes population (6.79 CFU × 10^{-5}).

Key words**:** Ambrette, NCU, Enriched pressmud compost, Sea weed extract, Soil properties

Ambrette (*Abelmoschus moschatus* Medic.) is a close relative to okra, a popular horticultural crop. It belongs to the family Malvaceae. The seed contains an essential oil and gives a strong flowery, musky dour of remarkable tenacity, because of the presence of ambretrolide, a macrocycliclactone in the seed coat. The seeds are used as tonic, aphrodisiac, diuretic, stomachic, demulcent and carminative. They allay thirst, check vomiting and cure diseases due to Kapha and Vata and are also useful in treating intestinal disorders, dyspepsia, urinary discharge, nervous debility, hysteria and skin diseases like itching and leukoderma [1].

Sole application of chemical fertilizers to meet the crop nutrient demand is deleterious both for soil and environment health [2]. Hence, organic manures from different sources could be an effective substitute for chemical fertilizers to improve crop yield. An imbalanced application of urea reduces the fertility of soil. In initial years, it may lead to higher production but simultaneously affect the production capacity of the land. Neem coated urea (NCU) has proved to be an effective natural way to reduce nitrification and leaching losses. Pressmud, when applied without composting to the soil, may lead to temporary lock up of nutrients. Composting of pressmud is necessary to reduce the lignin and cellulose contents and improve nutrient availability. Sea weed extract (SWE) is a marine algae rich in macro, micro nutrients and plant growth hormones viz., auxins, gibberellins and cytokinins. Its use as a manure in farming is practiced in Britain, France, Japan and China. Trace elements present in sea weed extract are in naturally chelated form and are readily available to plants [3].

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MATERIALS AND METHODS

The field experiment was conducted at Sivapuri Village, Chidambaram, Cuddalore District in Tamil Nadu during May to October, 2018 to find out the response of inorganic fertilizers, NCU, EPMC and SWE on physical, chemical and biological properties in sandy clay loam soil with ambrette as test crop. The treatments comprised of T_1– Absolute control; T_2– 100% RDF; T_3– 75% RDF -N (NCU);

T_4–75% RDF -P (EPMC); T_5– 75% RDF - N (NCU) + P (EPMC); T_6– T_3 + SWE; T_7- T_4 + SWE and T_8 – T_5 + SWE. The experiment was laid out in a randomized block design with three replications. The recommended dose of fertilizers (RDF) for ambrette was 120 : 30 : 40 kg $N:P_2O_5:K_2O$ ha^{-1}. Urea was blended with neem @ 5:1 ratio by weight and applied as per the treatment. The enriched pressmud compost (EPMC) was prepared with pressmud, SSP and *Pleurotus sp* and applied @ 1000 kg ha^{-1}. Sea weed extract (SWE) was applied @ 5 per cent as foliar spray three times at 30 days interval. After harvest of ambrette, post – harvest soil samples from each treatment in each replication was collected, air-dried, powdered, sieved and analyzed for their density, porosity, water holding capacity, soil reaction, electrical conductivity, organic carbon content and microbes based on standard procedures.

RESULTS AND DISCUSSION

Post – harvest soil physical properties (Table 1)

Bulk density (Mg m^{-3})

The bulk density of the soil for different treatments ranged from 1.37 to 1.46 (Mg m^{-3}). No significant differences observed between the treatments and soil bulk density. However, bulk density reduced considerably with the application of NCU, PMC and SWE. Application of organics would usually help the process of granulation of soil particles, thus increasing soil porosity and lowering soil bulk density. It may also be due to higher organic carbon and good soil aggregation [4].

Pore space (%)

The highest pore space of 50.62% was observed in T_8 which received 75% RDF + N (NCU) + P (EPMC) + SWE. This was on par with T_7 (75% RDF + N (NCU) + SWE) (49.85%). Application of 100% RDF recorded a pore space of 42.21% whereas control (T_1) recorded the lowest pore space (42.32%).

Water holding capacity (%)

The maximum value with respect to water holding capacity (34.95 %) was registered in T_8 (75% RDF + N (NCU) + P(EPMC) + SWE). This was followed by treatments T_6 (34.81%) and T_7 (34.62 %) which received 75% RDF + N (NCU) + SWE and 75% RDF + P(EPMC) + SWE, respectively. These treatments were statistically on par with each other. However, water holding capacity was minimum (28.27%) was noticed in control treatment.

Table 1 Influence of inorganic fertilizers, neem coated urea (NCU), enriched pressmud compost (EPMC) and sea weed extract (SWE) on soil physical properties with ambrette

Treatments	Bulk density (Mg m^{-3})	Pore space (%)	Water holding capacity (%)
T_1: Absolute control	1.46	42.32	28.27
T_2: 100% RDF	1.45	42.21	30.42
T_3: 75% RDF –N (NCU)	1.42	43.42	31.01
T_4: 75% RDF –P(EPMC)	1.43	42.82	32.62
T_5: 75% RDF –N (NCU) + P (EPMC)	1.41	44.27	31.58
T_6: T_3 + SWE	1.39	47.28	34.81
T_7: T_4 + SWE	1.38	49.85	34.62
T_8: T_5 + SWE	1.37	50.62	34.95
S. Ed	0.060	1.265	0.873
CD=0.05	NS	2.531	NS

Post- harvest soil chemical properties (Table 2)

pH (soil reaction)

Application of 75% RDF + N (NCU) + P(EPMC) + SWE recorded the lowest soil pH (6.8). Treatments T_2, T_3 and T_4 recorded soil pH values of 7.2, 7.1 and 7.0, respectively. Application of 75% RDF + N (NCU) + SWE (T_6) and 75% RDF + P(EPMC) + SWE (T_7) registered pH values of 6.8. These treatments showed no significant difference with respect to soil pH. The highest soil pH (7.4) was noticed in control (T_1). This might be due to incorporation of organic matter which would have helped in stabilizing the pH and resisting the fluctuation of pH due to different management practices [5].\

EC (Electrical conductivity) (dSm^{-1})

The highest electrical conductivity (0.41 dSm^{-1}) was found to be with control treatment (T_1) which received no organic manures and inorganic fertilizers. Application of 100% RDF (T_2), 75% RDF + N (NCU) (T_3), 75% RDF + P(EPMC) (T_4) and 75% RDF + N (NCU) + P(EPMC) (T_5) registered the electrical conductivity values of 0.42, 0.37, 0.39 and 0.28 dSm^{-1}, respectively. There was a tendency for decreasing soil electrical conductivity with increasing dose of compost [6].

CEC (cation exchange capacity) (cmol (p^+) kg^{-1})

Application of 75% RDF + N (NCU) + P(EPMC) + SWE (T_8) registered the highest CEC of (22.62 cmol (p^+) kg^{-1}) against 16.14 cmol (p+) kg^{-1} which was lowest cation exchange capacity recorded in control (T_1). The next best cation exchange capacity values of 22.32, 21.65 and 21.53 were found to be T_7, T_5 and T_6, respectively. Treatments T_8, T_6, T_5 and T_7 were statistically on par with each other. This was attributed to pressmud contains large amount of organic matter, micronutrients such as Zn, Cu, Fe and Mn. Thus, enhance beneficial microbial activities within soil system. Soil organic matter encourages granulation, increases cation exchange capacity (CEC) and enhance adsorbing power of the soil [7].

Table 2 Influence of inorganic fertilizers, neem coated urea (NCU), enriched pressmud compost (EPMC) and sea weed extract (SWE) on soil chemical properties with ambrette

Treatments	pH	EC (dSm^{-1})	CEC ($Cmol(p^+)\ kg^{-1}$)	OC ($g\ kg^{-1}$)
T_1: Absolute control	7.4	0.41	16.14	2.42
T_2: 100% RDF	7.2	0.42	16.06	2.83
T_3: 75% RDF –N (NCU)	7.1	0.37	18.23	2.61
T_4: 75% RDF –P(EPMC)	7.0	0.39	21.32	2.63
T_5: 75% RDF –N (NCU) + P (EPMC)	6.9	0.28	21.65	2.86
T_6: T_3 + SWE	6.8	0.33	21.53	3.17
T_7: T_4 + SWE	6.8	0.27	22.32	3.19
T_8: T_5 + SWE	6.8	0.28	22.62	3.20
S. Ed	0.02	0.01	0.566	0.087
CD=0.05	0.04	0.02	NS	0.175

Organic carbon ($g\ kg^{-1}$)

Among the treatments tried, control (T_1) registered the lowest soil organic carbon content (2.42 g kg^{-1}). The highest soil organic carbon content (3.20 g kg^{-1}) was found to be with 75% RDF + N (NCU) + P (EPMC) + SWE (T_8). This was followed by 3.19 and 3.17 g kg^{-1} were observed in T_7 and T_6, respectively which received 75% RDF + N (NCU) + SWE and 75% RDF + P(EPMC) + SWE, respectively. This was due to application of different combinations of phosphorus enriched compost, neem coated urea and sea weed extract along with different levels of chemical fertilizers [8]. Application of 100% RDF (T_2) registered an organic carbon content of 2.83 g kg^{-1}.

Soil microbial count

Bacterial population ($CFU \times 10^{-4}$)

Regarding bacterial population, the highest value (65.82 CFU × 10^{-6}) was recorded in the treatment (T_8) which received 75% RDF + N (NCU) + P(EPMC) + SWE. The treatment - T_6 75% RDF + N (NCU) registered a bacterial population of (57.43 CFU × 10^{-6}).

Fungal population ($CFU \times 10^{-4}$)

Among the different treatments, application of 75% RDF + N (NCU) + P(EPMC) + SWE (T_8) recorded the highest fungal population of 16.46 CFU×10^{-4}. Application of (T_6) 75% RDF + N (NCU) registered a fungal population of 13.92 CFU × 10^{-4}. However, the lowest fungal population (11.56 CFU × 10^{-4}) was recorded in control (T_1).

Table 3 Influence of inorganic fertilizers, NCU, EPMC and SWE on microbial population in the post-harvest soil of ambrette

Treatments	Bacteria ($CFU \times 10^{-6}$)	Fungi ($CFU \times 10^{-4}$)	Actinomycetes ($CFU \times 10^{-5}$)
T_1: Absolute control	44.32	11.56	5.04
T_2: 100% RDF	47.98	11.94	5.29
T_3: 75% RDF –N (NCU)	49.32	12.59	5.58
T_4: 75% RDF –P(EPMC)	51.87	12.84	5.83
T_5: 75% RDF –N (NCU) + P (EPMC)	54.92	13.48	5.91
T_6: T_3 + SWE	57.43	13.92	6.26
T_7: T_4 + SWE	62.76	14.87	6.47
T_8: T_5 + SWE	65.82	16.46	6.79
S. Ed	1.645	0.411	0.169
CD=0.05	3.291	0.823	0.339

Actinomycete population ($CFU \times 10^{-5}$)

Actinomycete population was significantly influenced by application of different combinations of inorganic fertilizers, neem coated urea (NCU), enriched pressmud compost (EPMC) and sea weed extract (SWE). Application of 75% recommended dose of fertilizers (RDF) + N (NCU) + P(EPMC) + SWE (T_8) recorded the highest actinomycete population (6.79 CFU×10^{-5}) whereas, the lowest actinomycete population (5.04 CFU × 10^{-5}) was recorded in control (T_1). The soil microbial population increased in organically amended plots compared to inorganic and control plots which might be due to the addition of enriched pressmud compost and sea weed extract that might have large impact on the activity of microbial population. It was also due to addition of enriched pressmud compost in soil creates a conducive environment and promotes high microbial activity. The enhanced biological activities in the compost treated soil are evidenced by relatively high carbon content and enzyme activities [9].

CONCLUSION

The study concluded that application of 75% RDF + N (NCU) + P(EPMC) + SWE enhanced soil physical properties, improved chemical properties and intensified microbial growth in ambrette grown soil. Hence, application of 75% RDF + neem coated urea + enriched pressmud compost and sea weed extract under IPNS can be beneficially exploited for the improvement of soil properties.

LITERATURE CITED

1. Rajeswari R, Shakila A. 2015. Influence of season and spacing on the growth performance of ambrette *(Abelmoschus moschatus Medic.). The Asian Journal of Horticulture* 10(1): 71-75.
2. Tolessa D, Sharnappa, Sudhir K, Sujith GM. 2001. Direct and interactive effect of enriched FYM and nitrogen levels on the productivity and nutrient uptake of maize. *Karnataka Journal of Agricultural Sciences* 14(1): 672-676.
3. Thirumaran G, Arumugam M, Arumugam R, Anantham P. 2009. Effect of Sea weed liquid fertilizer on growth and pigment concentration of (*cyamopsis tetrogonolaba* (L) Taub). *American – Eurasian journal of Agronamy* 2(2): 50-56.
4. Ghuman BS, Sur HS. 2006. Effect of manuring on properties and yield of rainfed wheat. *Journal of Indian Society of Soil Science* 54(1): 6-11.
5. Pingaleswaran S. 2017. Influence of inorganic fertilizers, organic waste and PGR with boron on the yield and quality of soybean (*Glycine max* (L.) Merrill) cv. CO.3. *M. Sc. Thesis,* submitted to Annamalai University, Tamil Nadu.
6. Ed-Haun C, Shih C, Re, Young HT. 2007. Effect of different application rate of organic fertilizer on soil enzyme activity and microbial population. *Soil Science and Plant Nutrition* 53: 132-140.
7. Sunil Kumar, Meena RS, Jinger D, Jatav HS, Banjara T. 2017. Use of pressmud compost for improving crop productivity and soil health. *International Journal of Chemical Studies* 5(2): 384-389.
8. Maragani V. 2018. Enhancement of sustained sunflower productivity through incorporation of integrated nutrients and phyto - hormone. *M. Sc. Thesis*, submitted to Annamalai University, Tamil Nadu.
9. Elliott LF, Lynch JM. 1994. Biodiversity- soil resilience and sustainable land use, Greenland, CAB International, Wallingford, UK. 1(1): 353-364.