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Effect of organic manures on root yield of Ashwagandha

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Abstract
The present study entitled "Effect of organic manures on root yield of Ashwagandha (*Withania somnifera* (L.) Dunal.)" Was carried out at Research Farm, Department of Forestry, IGAU, Raipur (C.G.) during Kharif season of 2016-17. The standardization of optimum requirement of nutrient as organic manures on Ashwagandha crop as intercropped with Karanj (*Pongamia pinnata*) based Agroforestry system. The trial was laid out in Randomized Block Design with eight treatments and three replications in this experiment. Fresh root yield (1,038.97 kg ha^{-1}), Dry root yield (2.74 $q.ha^{-1}$) and seed yield (96.53 kg ha^{-1}) was recorded in T_8 treatment as a control this is due to no use of any organic manure. The results revealed that the yield characters of Ashwagandha *viz.,* fresh root yield and dry root yield were recorded maximum in T_2 treatment. It can be concluded from the study conducted that the Ashwagandha crop Karanj (*Pongamia pinnata*) based Agroforestry system with application of Vermicompost (100%) @ 5 ton ha^{-1} ensure higher yield of root and as compared to other organic manure – FYM and neem cake and their combinations. Karanj (*Pongamia pinnata*) is a leguminous tree, which fixes the atmospheric nitrogen in the soil, to increase fertility and is not showed its negative effect on crop of Ashwagandha due to its moderate shading, but in lack of recommended dose of organic manure (vermicompost) the production of root and seed yield was found less. The results of this study clearly indicate that the Ashwagandha crop can be cultivated comfortably under Karanj (*Pongamia pinnata*) based Agroforestry system with application of organic manure– vermicompost.

Keywords: FYM, vermicompost, Ashwagandha, agroforestry

Introduction
Agroforestry is not new, in recent years its importance has increased dramatically especially as regards its potential for optimizing land use in the tropics. The state of Chhattisgarh is declared as an herbal state after it came in existence. The farmers carry out the large-scale plantations for timber and raw material for industries to meet out their requirements of raw material. Last three years onwards, the large-scale plantations of TBOs were carried out on wastelands and marginal lands for bio-diesel production purpose. Ashwagandha or Asgandh (*Withania somnifera* Dunal) popularly known as 'Indian Ginseng' belongs to the family Solanaceae. It is found in wild state in the Mediterranean region of North Africa. The important alkaloid present in the roots is withanine constituting 38 per cent of the total alkaloids. Other alkaloids recorded are somniferine, somniferinine, somnine, withanine, pseudowithanine, withananinine and withasomine (Majumdar, 1955) [5]. The total alkaloid content of the Indian roots is reported to vary between 0.13 to 0.31 per cent.

Materials and methods
The present investigation on "effect of organic manures on root yield of Ashwagandha" was carried out during session of 2016-17 at the research farm of Department of Forestry, Indira Gandhi Krishi Vishwavidyalaya, Raipur.

The black clayey soil of experimental field belongs to the order Vertisols and it is locally known as Kanhar. This Kanhar soil are characterized by fine texture, sticky nature, angular blocky structure, low to medium Nitrogen, high Potassium and low to medium Phosphorus with low Organic matter. The soil of experimental area is very rich in organic carbon and other nutrient because of the addition of litter in the soil every year.

The experiment was laid out in a randomized block design (RBD) with eight treatments and three replications. Ashwagandha was sown as intercrop under Karanj tree. The different combinations of organic manure were applied prior to planting and thoroughly mixed with the

soil in a year with single splits under Karaj based Agroforestry system. Plot size 4 × 3.25 (13 m^2) were demarcated in such a way that two trees come in each plot laid for 8 different treatments. The seed sown on the ridge with spacing 30 cm plant to plant and 60 cm row to row in all the plots prepared for the experiment. At the time of ridge and furrow preparation and before sowing of seed in each plot has been treated with the particular treatment according to the designed layout and as per recommended quantity of manure Basal dose: 100% FYM @ 10 ton ha^{-1} was applied in treatment T_1, 100 % Vermicompost @ 5 ton ha^{-1} was applied in treatment T_2, 100% Neem cake @ 4 ton ha^{-1} in treatment T_3, 50% FYM @ 5 ton ha^{-1} in combination with 50% Vermicompost @ 2.5 ton ha^{-1} in treatment T_4, 50% FYM @ 5 ton ha^{-1} in combination with 50 % Neem Cake @ 2 ton ha^{-1} in treatment T_5 and 50 % Vermicompost @ 2.5 ton ha^{-1} in combination with 50% Neem cake @ 2 ton ha^{-1} was applied in treatment T_6, 50% FYM @ 5 ton ha^{-1} in combination with 25% Vermicompost @ 1.25 ton ha^{-1} and 25% Neem Cake @ 1 ton ha^{-1} was applied in treatment T_7. Treatment T_8 was control.

Fresh root yield (Kg ha^{-1})

After harvesting five labeled plants, the remaining plants in the net plot were separately uprooted, roots separated and their fresh weight was recorded. Further, the weight of roots of five sampled plants was also added to obtain fresh root yield per net plot. The fresh root yield from each net plot was used for computing fresh root yield per hectare in each treatment and expressed as kilograms per hectare.

Dry root yield (q ha^{-1})

The fresh roots harvested from net plot were dried under sun and dry root yield per plot was recorded. The dry root yield per hectare was estimated based on the dry root yield obtained from the net plot and expressed in quintal per hectare.

Result and discussion

Fresh weight

Organic manure treatments showed significant difference on fresh root yield of Ashwagandha. The results on fresh root yield depicted in table 1 and fig. 1. Fresh root yield was recorded maximum in T_2 (1,340.77 kg ha^{-1}) followed by T_1 (1,213.85 kg ha^{-1}), while it was found minimum in T_8 (1,038.97 kg ha^{-1}). Vermicompost, may have increased the efficiency of added organic manures in the soil, activities of nitrogen fixing bacteria and increased rate of mummification which enhances the availability of both native and added nutrients in soil resulting in increased yield of fresh and dry weight of Ashwagandha in vermicompost treated plot rather than control. The results of the studied conducted also application of vermicompost significantly increased the root yield of Ashwagandha, which was higher in vermicompost treated plots than the other organic manure treated plots. The differential response of plants to vermicompost might be due to release of variable amount of available nutrients and growth- promoting substances.

Moreover, vermicompost plays an important role in improving soil texture, aeration, soil compaction and thus enhances more water and nutrients uptake by plants from their surrounding areas of root zone.

Table 1: Effect of organic manure on fresh root yield of Ashwagandha intercropped under Pongamia pinnata based Agroforestry system.

Treatments	Fresh wt. (kg ha^{-1})	Fresh wt. (q ha^{-1})
T_1 - FYM 100%	1,213.85	12.14
T_2 - VC 100%	1,340.77	13.41
T_3 - NC 100%	1,078.72	10.79
T_4 - FYM 50% + VC 50%	1,138.21	11.38
T_5 - FYM 50% + NC 50%	1,075.64	10.76
T_6 - VC50% + NC 50%	1,100.77	11.01
T_7 - FYM 50% + VC 25% +NC25%	1,121.03	11.21
T_8 – Control	1,038.97	10.39
SEm ±	2.24	
CD (at 5%)	6.79	

Dry weight

Application of organic manure showed significant difference on dry root yield of Ashwagandha. The results on dry root yield depicted in table 2 and fig. 2. Perusal of table showed that dry root yield was recorded maximum (3.61 q ha^{-1}) in T_2 - vermicompost 100% followed by T_1 - FYM 100% 3.21 q ha^{-1}, while minimum was (2.74 q ha^{-1}) in T_8.

Table 2: Effect of organic manure on dry root yield (q. ha-1) of Ashwagandha intercropped under Pongamia pinnata based Agroforestry system.

Treatments	Dry root wt.(q. ha^{-1})
T_1 - FYM 100%	3.21
T_2 - VC 100%	3.61
T_3 - NC 100%	2.83
T_4 - FYM 50% + VC 50%	2.99
T_5 - FYM 50% + NC 50%	2.77
T_6 - VC50% + NC 50%	2.89
T_7 - FYM 50% + VC 25% +NC25%	2.93
T_8 – Control	2.74
SEm ±	0.01
CD (at 5%)	0.03

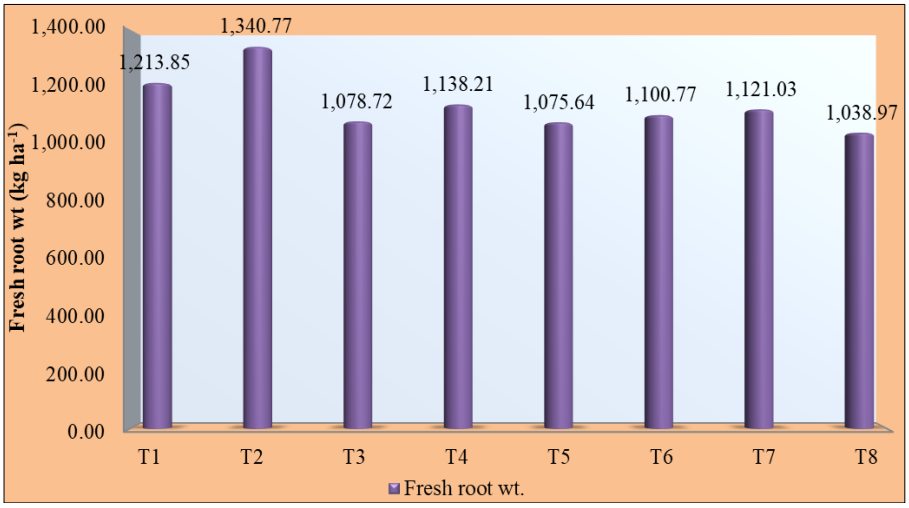

Fig 1: Effect of organic manure on fresh root yield of Ashwagandha intercropped under *Pongamia pinnata* based Agroforestry system.

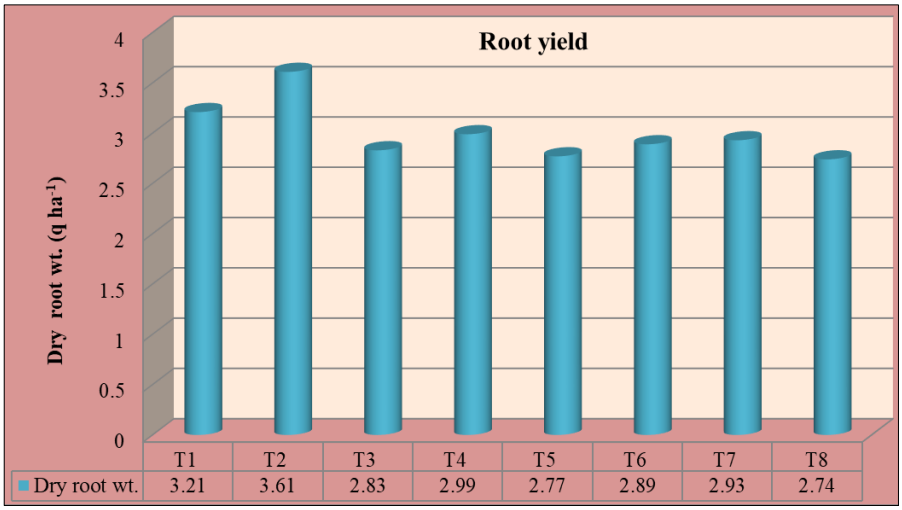

Fig 2: Effect of organic manures on dry root yield (q.ha^{-1}) of Ashwagandha intercropped under *Pongamia pinnata* based Agroforestry system.

Conclusion

Data on Ashwagandha crop were recorded after harvesting of crop. Root (fresh and dry) yield was found highest when crop is cultivated with T_2 treatment and found lowest in T_8 (control). Observations on vegetative growth parameters of Ashwagandha, *viz.*, plant height, collar diameter were measured at 30, 60, 90, 120, 150 and 180 DAS of crop and number of branches was measured at 120, 150 and 180 DAS of crop. Root length, root diameter, fresh root yield, dry root yield and seed yield were recorded after harvesting of the crop.

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