Studies on the influence of organic substitutions of nitrogenous fertilizer on growth and yield of aswagandha (*Withania somnifera)* grown as intercrop in coconut plantation

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Ashwagandha (*Withania somnifera*) is a herb that has been used to treat conditions such as fatigue, chronic disease, impotence and waning memory. Ashwagandha is specific for a wide range of conditions including arthritic inflammation, anxiety, insomnia, respiratory disorders, nervous disorders, gynecological disorders, male infertility and impotence. It is a herb that enhances resistance to stress, increases stamina and promotes general well-being. According to the Ayurvedic system, Ashwagandha is the best herb for balancing Vata in the body. Vata governs all movement in the body, including the movement of nerve impulses throughout the nervous system. Improved agro techniques including balance supply of nutrient is essential for good growth and attaining potential yield of the crop. Growing coconut as monocrop is the most inefficient way of using natural resources. A high spacing of 7.5 x 7.5 m in the square system is recommended mainly to accommodate the large crown of the palms, however, several studies revealed that natural resources *i.e.,* soil, water, air space and solar radiation are not fully utilized under this spacing schedule and much land space is generally left unproductive throughout the long life span of palms.

In the recent past, economy of coconut farmers in India had weakened due to the fluctuation in the price of coconut, copra and coconut oil. So, adoption of coconut based multiple cropping system emerges as the viable way for improving the economic status of coconut farmers. Keeping this in view a field experiment was carried out to study the effect of the 25% and 50% substitution of inorganic source of nitrogen (as urea) with five different organic manures namely FYM, vermicompost, Mustard cake, Neem cake and Groundnut cake on growth and yield of aswagandha grown as intercrop with coconut.

The experiment was carried out in a twenty five years old coconut plantation of AICRP on Palms, Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Nadia, during during 2005-07 . The coconut palms were spaced at 7.5 x 7.5 m. The experiment was laid out in RBD with three replications. Treatments comprised of T_1 ($OM_{0\%}$ + $U_{100\%}$), T_2 (FYM $_{25\%\ N}$ + U $_{75\%N}$), T_3 (FYM $_{50\%N}$ + U $_{50\%N}$), T_4(VC $_{25\%N}$ + U $_{75\%N}$), T_5 (VC $_{50\%N}$ + U $_{50\%N}$) , T_6 (MC $_{25\%N}$ +U $_{75\%N}$), T_7 (MC $_{50\%N}$ + U $_{50\%N}$), T_8(NC $_{25\%N}$ + U $_{75\%N}$), T_9 (NC $_{50\%N}$ + U $_{50\%N}$), T_{10} (GC $_{25\%N}$ + U $_{75\%N}$), T_{11} (GC $_{50\%N}$ + U $_{50\%N}$) and T_{12} (Control: No manure and fertilizer). seed was planted in the nursery during February. Seedlings were transplanted in the main plots during 15th April during both the years 2005-06 and 2006-07 with 40 x 40cm spacing. The soil of the experimental site was Gangetic alluvial with sandy loam texture having medium NPK (0.91%, 56.6ppm, 114.8ppm) and soil pH 6. Scheduled agronomical management practices were followed in aswagandha and coconut. The observations on different growth parameters were recorded from five randomly selected plants per replication. Yield was taken on net plot basis ($9m^2$) at harvest.

Different growth parameters, like plant height, leaf number, primary branch and secondary branch were recorded at 110 days after planting (DAP) .Data presented in Table1 clearly indicated that the different organic manures had significant influence on different growth and yield parameters. Maximum plant height (129.48cm), leaf number (158.0), primary branch (4.6) secondary branch(16.1), root weight (87.6g/plant)and plant weight (296.4g/plant) ware obtained under T_5 treatment where VC $_{50\%}$ + $U_{50\%}$ were applied as compared to the control treatment (88.33cm, 129.0,2.7, 6.1, 57.3 g and 148.8g , respectively) . These results are in good agreement with Ghosh *et al* (2007,08) Maheswari *et al* (2000) and Patel *et al.* (2004).

Total root weight is the reflection of total photosynthesis that occurred in the plant. Naturally a plant with good vegetative growth is indicative of its efficient photosynthesis and simultaneous partitioning of photosynthesis towards sinks. It was interesting to note that each organic manure treatment performed better over control. The vegetative vigour and yield contributing characters of ashawagandha differed with different manuring which was reflected in the rhizome yield. Increase yield under organic treatments midge be due to higher magnitude of yield attributes affected by increased pore space in the soil which helped in better aeration, infiltration and more macro pores thus more conservation of soil moisture and activity of

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microorganism in soil resulting in more availability of nutrients and ultimately more photosynthates.

Application of organic manures to the soil decreases both bulk density and particale density and increase percent pore space and water holding capacity. The magnitude of variation depends upon the nature and quality of manure applied (Manthan and Thilagavathi, 1997). Organic manures facilitate easy supply and availability of nutrients whereas nutrient available through fertilizer are not fully utilized by the crop. The enhanced microbial activites caused the transportation of soluble nitrogen into microbial protein, thereby preventing nitrogen loss by leaching (Tiwari *et. al*., 1989). Gradual availability of nutrient through decomposition throughout the growth phase may be the probable cause for better growth and higher yield when inorganic fertilizers were substituted by the organics at different level. For good growth and better yield of aswagandha inorganic fertilizer may be integrated with 50% substitution of urea by organic manure like vermicompost (8.5 t/ha) or neem cake (2.5 t/ha).

Table 1: Effect of different dose of manure and fertilizer on growth and yield of aswagandha (pooled data)

Treatment	Plant height (cm)	No. of leaves per plant	No. of primary branch	No. of secondary branch	Plant weight (g)	Root weight (g)
T_1 ($OM_{0\%}$ +$U_{100\%}$)	120.0	136.6	2.8	10.3	211.6	63.2
T_2 (FYM $_{25\%\ N}$ + U $_{75\%N}$)	106.3	139.6	2.9	11.5	216.8	65.3
T_3 (FYM $_{50\%N}$ + $U_{75\%N}$)	115.4	140.6	3.3	12.5	226.4	68.5
T_4(VC $_{25\%N}$ + U $_{75\%N}$)	121.3	152.0	4.2	13.6	275.5	85.6
T_5 (VC $_{25\%N}$ + U $_{75\%N}$)	129.4	158.0	4.6	16.1	296.4	87.6
T_6 (MC $_{50\%N}$ +U $_{50\%N}$)	112.3	142.0	3.6	9.2	220.2	72.8
T_7 (MC $_{50\%N}$ + U $_{50\%N}$)	115.6	145.0	3.8	10.4	226.4	76.5
T_8(MC $_{25\%N}$ + U $_{75\%N}$)	113.5	150.0	4.1	11.6	236.3	76.2
T_9 (NC $_{50\%N}$ + U $_{50\%N}$)	120.2	152.0	4.3	12.3	255.6	82.3
T_{10} (GC $_{25\%N}$ + U $_{75\%N}$)	111.4	149.0	4.1	10.4	230.5	78.5
T_{11} (GC $_{50\%N}$ + U $_{50\%N}$)	117.2	157.0	4.2	12.5	245.4	80.4
T_{12} (Control)	88.3	129.0	2.7	6.1	148.8	57.3
SEm (±)	**2.87**	**10.434**	**0.236**	**0.548**	**3.202**	**2.228**
LSD(0.05)	**5.97**	**21.638**	**0.489**	**1.136**	**6.640**	**4.620**

OM= organic manure, U= urea, FYM= farm yard manure, VC= vermicompost, MC= mustard cake, NC= neem cake, GC= groundnut cake

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