Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.3, No.14, 2013

Effect of Integrated Supply of different fertilizers and compost on Total Yield of *Andrographis paniculata* at Harvesting Stage

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Abstract
The present investigation was carried out to study the effects of Bio fertilizers, Chemical Fertilizers and Vermicompost and their combination on the Productivity of *Andrographis paniculata*. The experiment was conducted in a randomized block design (RBD) with 8 treatments i.e. T_1-NT, T_2- VC, T_3-BF, T_4-CF, T_5-BF+VC, T_6-BF+CF, T_7 - CF + VC, T_8 - BF+CF+VC. The experimental results revealed that maximum fresh and dried weight of root, shoot and leaves individually as well as total weight of all the parts and maximum seed yield was obtained in T_8 treatments followed by T_5 plot treatment. Thus it can be concluded that integrated combination of organic manures along with BF and CF results into improved plant productivity and seed yield.

Introduction

Fertilizer application to crops is a necessary condition for good yield of crops due to inherent low fertility status of the soils. The developmental strategy of medicinal plant production in the present century must be through increased productivity of the land under cultivation, reduced costs of production and higher input use efficiency with no harm to the soil, ground water, environment and product quality. The stability of production depends on replenishing nutrients removed from the soil by crops, maintaining desirable physical condition of the soil, preventing an increase in soil acidity and toxic elements and minimizing or preventing erosion. Use of fertilizers is reported to be responsible for over 50% yield increase in crops. Beneficial effect of bio fertilizers, chemical fertilizers and vermicompost in crop productivity has already been reported by many researchers (Jat *et al.,* 2006 in Gram; Dubey *et al.,* 2012 in Fenugreek). Rate of production will be calculated by taking fresh and dried weight of the plant parts and seeds in fully mature crop at harvesting stage.

Material and methods

The field experiment was conducted at Sarojini Naidu Govt. Girls P.G. (Autonomous) college, Bhopal of Madhya Pradesh. The experiment was conducted in a randomized block design (RBD) with 8 treatment using chemical fertilizers (NPK), vemicompost, and biofertilizers (*Azotobacter*, phosphate solubilizing bacteria) in different combinations including one control treatment. The treatments were were T_1 - control (no treatment), T_2 -Vermicompost 5t ha^{-1}, T_1 _Biofertlizers (250g *Azotobacter* ha^{-1} + 250g PSB ha^{-1}), T_4 - Chemical fertilizers (60:30:30kg NPK ha^{-1}), T_5 _BF + VC (125g *Azotobacter* + 125g PSB + 5t vermicompost ha^{-1}), T_6 - BF + CF [125g *Azotobacter* + 125g PSB + 50% NPK (RDF) ha^{-1}], T_7 _CF + VC (50% NPK + 5t vermicompost ha^{-1}) and T_8 - BF + CF + VC [250g biofertilizers (125g *Azotobacter* + 125g PSB) + 50% NPK (RDF) + 5t VC. The Net plot size of each plot was 9.62 (approx. 10) m^2 and spacing of rows were 15 cm.

The crop is ready for the harvest after 135 days of sowing, when the plants started flowering and leaves undergoing senescence. At this stage they are harvested by cutting the plants at the base. For the analysis of fresh weight plant parts uprooted and partitioned into leaves, stem, roots and reproductive parts and whole plants were dried in sunlight. For the measurement for total yield, it has weighed by electrical analytical balance. The yield per hectare was computed and expressed as quintal per hectare.

Seed yield

The seeds were separated by winnowing. Total seed yield per plot was worked out by adding the seed weight of all the seeds.

Statistical Analysis

Analysis of observations taken on different variable was carried out to know the degree of variation among all the treatments. The results were obtained through analysis of variance (ANOVA) and SPSS software, version 20, 2011.

Result and Discussion

Table 1. Effect of INM on Fresh and Dry matter production (Kg/plot) at 135 DAS of *A.paniculata*

Plot No.	Treatment	RW		SW		LW		TW	
		RFW	RDW	SFW	SDW	LFW	LDW	TFW	TDW
T_1	NT	84.1	28.2	133.5	44.8	81.7	27.0	299.3	100.0
T_2	VC	151.8	50.4	307.3	102.4	148.9	49.6	608.0	202.4
T_3	BF	131.4	44.7	283.5	95.1	129.2	43.0	544.1	182.8
T_4	CF	127.1	40.9	254.1	71.5	114.6	38.8	495.9	151.2
T_5	BF+VC	183.1	60.7	390.0	132.6	175.8	59.1	748.9	252.4
T_6	BF+CF	178.5	59.8	387.9	122.9	173.7	58.3	740.1	241.0
T_7	CF+VC	181.0	60.2	389.2	130.9	174.8	58.9	745.0	250.0
T_8	BF+CF+VC	209.4	69.7	440.1	147.0	185.7	62.5	835.2	279.2
Mean		155.8	51.82	323.2	105.9	148.0	49.65	627.0	207.3
SD		40.25	13.42	99.47	34.56	36.72	12.47	175.9	60.29
SEm		14.2	4.747	35.16	12.2	12.98	4.411	62.21	21.31
95% confidence interval of the difference	Lower	122.1	40.59	240.0	77.00	117.3	39.21	479.9	156.9
	Upper	189.4	63.05	406.3	134.7	178.7	60.08	774.1	257.7

Table 2. Effect of INM on Average Seed yield (g/plot) at 135 DAS of *A. paniculata*

Plot No.	Treatment	Seed yield in g/plot
T_1	NT	1024.3
T_2	VC	1624
T_3	BF	1441
T_4	CF	1267.8
T_5	BF+VC	1976.7
T_6	BF+CF	1743.2
T_7	CF+VC	1914.3
T_8	BF+CF+VC	2024.7
mean		1627.0000
SD		359.24048
SEm		127.01069
95% confidence interval of the difference	Lower	1326.6674
	Upper	1927.3326

Table 3. Effect of INM on Fresh and Dry matter production (q/ha) at 135 DAS of *A. paniculata*

Plot No.	Treatment	RW		SW		LW		TW	
		RFW	RDW	SFW	SDW	LFW	LDW	TFW	TDW
T_1	NT	8	3	13	4	8	3	29	10
T_2	VC	16	5	31	10	15	5	62	20
T_3	BF	13	4	28	10	13	4	54	18
T_4	CF	13	4	25	7	11	4	49	15
T_5	BF+VC	19	6	39	13	18	6	76	25
T_6	BF+CF	18	6	39	12	17	6	74	24
T_7	CF+VC	18	6	39	13	17	6	74	25
T_8	BF+CF+VC	21	7	44	15	19	6	84	28
Mean		15.75	5.125	32.25	10.5	14.75	5	62.75	20.625
SD		4.2003	1.3562	10.124	3.5857	3.8079	1.1952	18.069	6.046
SEm		1.485	0.4795	3.5795	1.2677	1.3463	0.4226	6.3885	2.1376
95% confidence interval of the difference	Lower	12.238	3.9912	23.786	7.5023	11.566	4.0008	47.644	15.571
	Upper	19.262	6.2588	40.714	13.498	17.934	5.9992	77.856	25.68

Table 4.Effect of INM on Average Seed yield (kg/ha) at 135 DAS of *A. paniculata*

Plot No.	Treatment		Seed yield kg / ha
T_1	NT		10
T_2	VC		16
T_3	BF		14
T_4	CF		13
T_5	BF+VC		20
T_6	BF+CF		17
T_7	CF+VC		19
T_8	BF+CF+VC		20
Mean			16.1250
SD			3.60307
SEm			1.27388
95% confidence interval of the difference		Lower	13.1128
		Upper	19.1372

Maximum fresh and dried weight of root, shoot and leaves individually as well as total weight of all the parts and maximum seed yield recorded was in T_8 treatments followed by T_5 plot treatment. Conjunctive use of BF, CF and VC i.e. BF+CF, BF+VC, CF+VC and alone treatment gave significantly higher results compared to non-treated plants. Same results has been already reported by Pal., (2002) in Brahmi; Chand *et al.,* (2011) in Geranium; Gupta *et al.*, (2011) in black Henbane, Abbey and Kanton, (2004) in Onion; Shashidhar KR., *et al*.,(2009) in Mulberry; Prabhu M. *et al*., (2006) in Cucumber.

Nutrient management in integrated manner is beneficial for crop productivity. So it can be concluded that organic manure and bio fertilizers can replace around 25 to 50 percent of CF as already reported by Kandeel *et al.,* 2002 in *Ocimum basilicum*; Manjuntha *et al.,* 2002 in Patchouli; Shivalingappa., 2001 in Tuberose.

Thus it can be concluded that integrated combination of VC along with BF and CF results into improved plant productivity and seed yield. This also results into reducing the nutrient loss from the soil.

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