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Research Article

Soil fertility status of ashwagandha as influenced by concentrations and methods of application of *Panchagavya*

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Summary

The field experiments were conducted to study the available N,P,K and S in soil with the effect of *Panchagavya* made from cow (PG-C) and buffalo (PG-B) products sprayed to plants and applied to soil with different concentrations (3 and 5 per cent to plant and 9 and 15 per cent to soil) at different intervals (3 sprays - 30, 60 and 90 DAS; 4 sprays - 20, 40, 60 and 80 DAS) during *Rabi* 2007-08 and *Kharif* 2008. The available nutrients *viz*., N, P, K, and S was highest with *PG*-C @ 15% to soil (T_{10}) but it was at par with soil application of PG-B @ 15% to soil and *PG*-C @ 5% - 4 sprays.

Key words : Ashwagandha, *Panchagavya*, Available N,P,K and S

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Table A: Nutrient composition of *panchakavya* made from cow and buffalo products

Chemical and biological composition	*panchakavya* made from cow	*panchakavya* made from buffalo
N (%)	0.44	0.3
P (%)	0.41	0.35
K (%)	1.02	1.08
S (mg kg^{-1})	30	32
Zn (mg kg^{-1})	28	24
Fe (mg kg^{-1})	87	76
Mn (mg kg^{-1})	20	22
Cu (mg kg^{-1})	17	20
Yeast (CFU/ ml)	38 x 10^4	32x10^4
Actinomycetes (CFU/ml)	4 x 10^2	4.7x10^2
Lactic acid bacteria (CFU/ml)	26 x 10^6	24x10^6
pH	7.4	7.8

Resource and Research Methods

A field experiment was conducted to study the effect of *Panchagavya* on soil available nutrient status and yield of Ashwagandha at College Farm, College of Agriculture, Rajendranagar, ANGRAU on a sandy clay loam soil during *Rabi* 2007-08 (I year) and *Kharif* 2008 (II year). The experiment was laid out in Randomized Block Design with 12 treatments.

Treatmental details :

T_1 – *Panchagavya* (cow) spray @ 3 per cent with 3 sprays at 30, 60 and 90 DAS

T_2 – *Panchagavya* (cow) spray @ 5 per cent with 3 sprays at 30, 60 and 90 DAS

T_3 – *Panchagavya* (cow) spray @ 3 per cent with 4 sprays at 20, 40, 60 and 80 DAS

T_4 – *Panchagavya* (cow) spray @ 5 per cent with 4 sprays at 20, 40, 60 and 80 DAS

T_5 – *Panchagavya* (buffalo) spray @ 3 per cent with 3 sprays at 30, 60 and 90 DAS

T_6 – *Panchagavya* (buffalo) spray @ 5 per cent with 3 sprays at 30, 60 and 90 DAS

T_7 – *Panchagavya* (buffalo) spray @ 3 per cent with 4 sprays at 20,40,60 and 80 DAS

T_8 – *Panchagavya* (buffalo) spray @ 5 per cent with 4 sprays at 20,40,60 and 80 DAS

T_9 – *Panchagavya* (cow) spray @ 9 per cent to soil as basal application

T_{10} – *Panchagavya* (cow) spray @ 15 per cent to soil as basal application

T_{11} – *Panchagavya* (buffalo) spray @ 9 per cent to soil as basal application

T_{12} – *Panchagavya* (buffalo) spray @ 15 per cent to soil as basal application

The recommended nitrogen was applied in three equal splits at basal, 30 DAS and at flowering stage through urea. Entire phosphorus was applied as basal through single superphosphate. Potassium was applied in two equal splits at basal and at flowering stage through muriate of potash. Bio fertilizers were applied by mixing each 5 kg of *Azospirillum* and PSB (Phosphorous Solubilising Bacteria) in 50 kg FYM ha^{-1} and applied in two splits at basal and at 30 DAS in crop rows.

Spraying of *Panchagavya* :

Panchagavya made from cows and buffalo products was sprayed as per treatments at different days after sowing in different concentrations.

Preparation of *Panchagavya* :

Panchagavya is an organic product prepared by mixing five products obtained from cow *viz.*, cow dung (5 kg), cow urine (3 litres), cow milk (2 litres), cow curd (2 litres) and cow ghee (1 litre). In addition to the above products, sugarcane juice (3 litres), tender coconut water (3 litres) and riped banana (1 kg) was also added to get 20 litres of *panchagavya* stock solution. The mixture is placed in a wide mouthed mud pot and kept under shade. The contents were stirred twice a day for about 20 minutes, both in the morning and in the evening to facilitate aerobic microbial activity. About 10 days after fermentation, it was used for spraying (Natarajan, 2003). The nutrient composition of *panchagavya* was presented in Table A. The soil samples were collected at flowering and harvest and analysed for available N, P, K and S by adopting standard procedures.

Research Findings and Discussion

The data on available N, P, K, S, status in soil during *Rabi* 2007– 2008 and *Kharif* 2008 at flowering and harvest of Ashwagandha are presented in the Table 1 and 2. In general the available N, P, K and S in soil was decreased at harvest

Table 1 : Effect of *Panchagavya* (made from cow and buffalo products) on available nitrogen and phosphorus at flowering and harvest of Ashwagandha during *Rabi* 2007 - 2008 (I year) and *Kharif* 2008 (II year)

Treatments		Soil available nitrogen (kg ha^{-1})				Soil available phosphorus (kg ha^{-1})			
		Rabi 2007-2008		*Kharif* 2008		*Rabi* 2007-2008		*Kharif* 2008	
		Flowering	Harvest	Flowering	Harvest	Flowering	Harvest	Flowering	Harvest
T_1	*PG* - C @ 3% - 3 sprays	216	193	178	171	17.47	17.44	18.94	16.79
T_2	*PG* - C @ 5% - 3 sprays	227	198	189	184	19.57	17.56	19.25	17.96
T_3	*PG* - C @ 3% - 4 sprays	222	202	183	176	18.66	17.84	19.01	17.98
T_4	*PG* - C @ 5% - 4 sprays	236	212	198	191	20.71	19.34	20.29	19.78
T_5	*PG* - B @ 3% - 3 sprays	221	192	177	170	17.02	16.85	17.87	16.15
T_6	*PG* - B @ 5% - 3 sprays	226	198	184	182	19.21	18.76	19.65	19.45
T_7	*PG* - B @ 3% - 4 sprays	222	199	186	176	18.07	17.33	18.32	16.44
T_8	*PG* - B @ 5% - 4 sprays	233	204	195	186	17.80	17.14	19.74	17.39
T_9	*PG* - C @ 9% to soil	230	208	196	180	20.09	19.26	19.36	18.08
T_{10}	*PG* - C @ 15% to soil	239	214	210	192	21.85	21.84	20.81	20.61
T_{11}	*PG* - B @ 9% to soil	221	203	190	177	19.05	19.03	19.03	17.96
T_{12}	*PG* - B @ 15% to soil	238	213	207	190	20.36	20.26	20.37	20.26
	C.D. (P = 0.05)	NS	7.2	5.8	4.1	1.920	1.760	NS	2.080
	S.E.±	2.8	3.1	2.5	1.7	0.79	0.62	1.70	0.85
		Initial soil available nitrogen (kg ha^{-1})				Initial soil phosphorous (kg ha^{-1})			
		203		200		17.08		17.12	

PG - C Panchagavya made from cow products, *PG - B Panchagavya* made from buffalo products, 3 sprays at 30, 60 and 90 DAS, 4 sprays at 20, 40, 60 and 80 DAS, *Panchagavya* applied to soil as basal

Table 2 : Effect of *Panchagavya* (made from cow and buffalo products) on available potassium in and sulphur at flowering and harvest of Ashwagandha during *Rabi* 2007 - 2008 (I year) and *Kharif* 2008 (II year)

Treatments		Soil available potassium (kg ha^{-1})				Soil available sulphur (ppm)			
		Rabi 2007-2008		*Kharif* 2008		*Rabi* 2007-2008		*Kharif* 2008	
		Flowering	Harvest	Flowering	Harvest	Flowering	Harvest	Flowering	Harvest
T_1	*PG* - C @ 3% - 3 sprays	290	266	258	242	10.23	10.02	10.45	10.12
T_2	*PG* - C @ 5% - 3 sprays	307	283	266	250	10.87	10.72	10.64	10.35
T_3	*PG* - C @ 3% - 4 sprays	301	270	262	247	10.64	10.55	10.33	10.20
T_4	*PG* - C @ 5% - 4 sprays	316	300	288	273	10.96	10.80	10.97	10.64
T_5	*PG* - B @ 3% - 3 sprays	282	261	255	250	10.30	10.19	11.02	10.65
T_6	*PG*- B @ 5% - 3 sprays	308	280	274	258	10.88	10.74	10.87	10.64
T_7	*PG* - B @ 3% - 4 sprays	296	274	270	252	10.92	10.53	10.65	10.55
T_8	*PG* - B @ 5% - 4 sprays	312	293	283	266	10.90	10.64	10.49	10.32
T_9	*PG*- C @ 9% to soil	321	301	298	276	10.43	10.33	10.58	10.24
T_{10}	*PG* - C @ 15% to soil	328	309	307	290	10.60	10.42	10.88	10.75
T_{11}	*PG* - B @ 9% to soil	321	293	286	260	10.22	10.06	10.96	10.42
T_{12}	*PG* - B @ 15% to soil	322	305	304	286	10.48	10.30	10.54	10.30
	C.D. (P = 0.05)	16.03	18.12	17.84	16.65	NS	0.18	0.09	NS
	S.E.±	6.83	8.05	6.43	6.12	0.07	0.09	0.05	0.10
		Initial soil potassium (kg ha^{-1})				Initial soil availble sulphur (kg ha^{-1})			
		287		263		10.60		10.12	

PG - C Panchakavya made from cow products, *PG - B panchakavya* made from buffalo products, 3 sprays at 30, 60 and 90 DAS, *Panchagavya* applied to soil as basal, 4 sprays at 20, 40, 60 and 80 DAS

when compared with flowering

Available nitrogen :

During *Rabi* 2007–2008, the available N in soil was significantly influenced by all the treatments at harvest, however, it was non significant at flowering (Table 2). All the treatments resulted in build up of available N when compared to the initial available N. The highest available N was noticed with PG- C @15% to soil at both stages (239 and 214 kg ha^{-1} during *Rabi* 2007-08 and 198 and 191 kg ha^{-1} during *Kharif* 2008, respectively) however, it was at par with PG- B @ 15% to soil at harvest. The lowest was noticed with PG-C 3% - 3 sprays at both flowering and harvest in both the years.When compared to initial available N (203 kg ha^{-1}) all the treatments showed build up of available N. Soil application of PG-C @ 15% showed highest build up (5.42%) where as foliar spray of PG – B @ 3% -3 sprays resulted highest depletion of available N (-5.42%) at harvest. In *Kharif* 2007-08, at harvest all the treatments showed depletion of available N. The highest depletion was noticed with PG - B @ 3% - 3 sprays^{-1} (5.00%) when compared with initiail available soil N (200 kg ha^{-1}).

Available phosphorus :

During *Rabi* 2007-2008, the effect of different treatments on soil available P at flowering and harvest was found to be significant. At both stages soil application of PG - C @ 15% showed the highest soil available P (21.85 and 21.84 kg ha^{-1}, respectively) however, it was at par with PG- C @ 5% - 4 sprays at flowering. The lowest was noticed with PG - B @ 3% - 3 sprays at both stages. At harvest, application of PG - B @ 3% - 3 sprays showed depletion of soil P ($^{-1}$.35%) remaining all other treatments recorded build up of available P when compared with initial available soil P (17.08 kg ha^{-1}).

During *Kharif* 2008, the soil available P was significantly influenced by different treatments at harvest but it was found to be non significant at flowering. At harvest, application of PG-C @ 15% to soil recorded the highest soil available P (20.61 kg ha^{-1}) which was at par with PG - B @ 15% to soil. The lowest was noticed with PG - *B* @ 3% - 3 sprays. All the treatments recorded build up of available P. The highest build up was noticed with PG - C @ 15% to soil when compared with initial available soil P (17.12 kg ha^{-1}).

Available potassium :

There was significant effect on available K observed with all treatments at flowering and harvest in both the years. During *Rabi* 2007-2008 and *Kharif* 2008, the highest available K was obtained from PG- C @ 15% to soil (328, 309 and 307, 290 kg ha^{-1}, respectively) which was at par with PG- B @ 15% to soil at both stages. The highest build up was recorded with PG - C @ 15% to soil when compared with initial available K at both stages in both the years.

Available sulphur :

All the treatments resulted in build up of available S when compared to the initial available S. During *Rabi* 2007 - 2008, the available S in soil was significantly influenced by all the treatments at harvest, however, it was non significant at flowering. At flowering, the highest was noticed with PG - C @ 5% - 4 sprays. At harvest, foliar application of PG -C @ 5% - 4 sprays recorded the highest available S (10.80 kg ha^{-1}) however, it was at par with PG- B @ 5% - 3sprays. When compared with initial value (10.60 kg ha^{-1}), foliar application of PG -C @ 5% - 4 sprays showed highest build up. During *Kharif* 2008, all the treatments exerted non significant influence on available S at both stages of Ashwagandha. At flowering, the highest soil S was noticed with PG - B @ 3% - 3 sprays and the lowest was recorded with PG - C @ 3% - 4 sprays. At harvest, the lowest noticed with PG- C @ 3% - 3 sprays and the highest was obtained with *PG*-C @ 15% to soil. The soil organic matter content has marginally increased, due possibly to the use of organic inputs, but this change was not statistically significant.

Among the treatments, soil application of PG-C @ 15% recorded highest available N, P, K which was at par with PG-B @ 15% to soil. This might be due to possible role of micro organisms present in *Panchagavya* which helped to convert the nutrients from unavailable form to available form and also they might have played important role in root proliferation which might have helpd to solubulisation of nutrients (by root exudates) thus increase availablity of nutrients. This might be also due to the increase in microbial population (Zachariah, 2002). Presence of growth regulatory substances such as gibberellic acid (GA) and cytokinin, essential plant nutrients, naturally occurring, beneficial effective micro organisms (EMO's), predominantly lactic acid bacteria, yeast, actinomycetes, photosynthetic bacteria and certain fungi besides beneficial and proven bio-fertilizers such as *Azatobacter, Azospirillum* and *Phosphobacterium* and plant protection substances can be detected in *Panchagavya* (Somasundaram *et al*., 2004).

With the process of converting cow dung into compost, which is many times better than spreading the dung directly on to the fields, value can also be added and the results in the form of better yields, more healthy foods and feeds can be perceived quickly (Ramesh *et al.*, 2005).

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