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Effect of zero budget natural farming on nutrient content and uptake of wheat (*Triticum aestivum* L.)

Komal Gupta and SS Bhadauria

Abstract
A field experiment was conducted during *Rabi* season of 2019-20 and 2020-21 at Research Farm, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior (M. P.). The experiment consisted fifteen treatments replicated thrice using the wheat variety 'RVW-4106', The results revealed that the treatment of T_{15}: 100% RDF (N:P:K 120:60:40 kg ha^{-1}) significantly higher N, P and K uptake by grain and N and K uptake by straw (kg ha^{-1}). Whereas, zero budget natural farming significantly highest N, P and K uptake by grain and straw was obtained under treatment of T_{12}: Beejamrutha + Jeevamrutha + Panchgavya (1000 ml + 500 l + 15 lit. ha^{-1}), which, was significantly superior to others, but it was statistically at par with T_{13}: Beejamrutha + Panchgavya + Ghanajeevamrutha (1000 ml + 15 lit. + 25 kg ha^{-1}), T_{14}: Ghanajeevamrutha + Jeevamrutha + Beejamrutha (25 kg + 500 l + 1000 ml ha^{-1}), T_9: Jeevamrutha + Panchgavya (500 l + 15 lit. ha^{-1}), T_7: Beejamrutha + Panchgavya (1000 ml + 15 lit. ha^{-1}), T_6: Beejamrutha + Jeevamrutha (1000 ml + 500 l ha^{-1}), T_{11}: Panchgavya + Ghanajeevamrutha (15 lit. + 25 kg ha^{-1}) and T_{10}: Jeevamrutha + Ghanajeevamrutha (500 l + 25 kg ha^{-1}). The lowest N, P and K uptake by grain and straw was observed under T_1: Control. No significant effect of different zero budget natural farming on N, P and K content (%) grain and straw, available nitrogen, phosphorus and potassium (kg ha^{-1}) in soil after harvests.

Keywords: Wheat, zero budget natural farming, nutrient uptake

Introduction
Green revolution technologies played a great role in alleviating hunger but have also resulted in some adverse effects on our natural resources. Post green revolution, usage of chemical fertilizers involved single or combinations of nitrogen, phosphorus and potassium components in the fertilizers have hampered soil health by reducing organic content, increasing salinity, disturbing local pH (Wang *et al.*, 2008 [11] lands continue to shrink and there is a greater threat to global environment and soil resources. All the nations facing problems of poverty, hunger and malnutrition will need to accelerate their agricultural growth for achieving sustainable development goals, especially while aiming at no poverty, zero hunger and safe environment for all. Hence, there is now a great concern to maintain soil health and protect environment by popularizing eco-friendly and cost effective organic manures. Wheat (*Triticum aestivum* L.) is foremost among cereals and indeed among all crops, as direct source of food for human beings. Wheat is the second most important food after rice in India and contributes nearly 35% to the national food basket. In India, the wheat production is about 10.76 lakh tonnes from an area of around 3.15 lakh ha and productivity of 3421 kg ha^{-1} (Anonymous, 2019-20) [1]. Natural farming is a holistic method in which farmers are discouraged to buy market based inputs like chemical fertilizers, chemical pesticides etc. for growing plants within low budget and encourage to grow healthy soil with friendly earthworms and thereby grow healthy plants is claimed to be a panacea for natural farming. Palekar (2006) [7] revealed that availability and uptake of nutrients by crops was increased by the application of Jeevamrutha. The Jeevamrutha should be prepared from dung and urine of Indian cow only and dung and urine of one cow is sufficient for organic cultivation of 12 ha (Palekar, 2009) [8]. Natural farming uses a variety of methods to improve soil fertility including application of Jeevamrutha which is one of the most important components for nutrient management. Chandrakala (2008) [4] reported that the combined application of Beejamritha, Jeevamritha and Panchagavya increased yield and dry matter production in chilli.

Since, there is no scientific information available on the application time and effect of doses of 'Jeevamrutha' on the productivity of the crops under 'natural farming system', the present study was conducted to evaluate the efficacy of Jeevamrutha on growth, yield attributes and yield of wheat and to work out the economics of the treatments.

Materials and Methods

A field experiment titled, "effect of zero budget natural farming on nutrient content and uptake of wheat (*Triticum aestivum* L.)" was carried out during *Rabi* season of 2019-20 and 2020-21. The experiment was conducted at Research Farm, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior (M. P.). The soil of experiment site was sandy clay loam in texture and acidic in reaction (pH 7.3), medium in organic carbon (0.54%), low in available nitrogen (195.57 kg ha^{-1}), high in available phosphorus (18.50 kg ha^{-1}) and medium in available potassium (253.80 kg ha^{-1}). The experiment was laid out in randomized block design comprising of Fifteen treatments; T_1: Control, T_2: Beejamrutha (1000 ml ha^{-1}), T_3: Jeevamrutha (500 l ha^{-1}), T_4: Panchgavya (15 lit ha^{-1}), T_5: Ghanajeevamrutha (25 kg ha^{-1}), T_6: Beejamrutha + Jeevamrutha (1000 ml + 500 l ha^{-1}), T_7: Beejamrutha + Panchgavya (1000 ml + 15 lit. ha^{-1}), T_8: Beejamrutha + Ghanajeevamrutha (1000 ml + 25 kg ha^{-1}), T_9: Jeewamrutha + Panchgavya (500 l + 15 lit. ha^{-1}), T_{10}: Jeevamrutha + Ghanajeevamrutha (500 l + 25 kg ha^{-1}), T_{11}: Panchgavya + Ghanajeevamrutha (15 lit. + 25 kg ha^{-1}), T_{12}: Beejamrutha + Jeevamrutha + Panchgavya (1000 ml + 500 l + 15 lit. ha^{-1}), T_{13}: Beejamrutha + Panchgavya + Ghanajeevamrutha (1000 ml + 15 lit. + 25 kg ha^{-1}), T_{14}: Ghanajeevamrutha + Jeevamrutha + Beejamrutha (25 kg + 500 l + 1000 ml ha^{-1}) and T_{15}: 100% RDF (N:P:K 120:60:40 kg ha^{-1}). Each treatment was allocated randomly and replicated three times under randomized block design. All the recommended cultural operations were followed throughout the experimentation. Observations were recorded on N, P and K content (%) and uptake by grain and straw and available nitrogen, phosphorus and potassium kg ha^{-1} in soil of wheat.

Results and Discussion

Effect on N, P and K content (%) in grain and straw

The N, P and K content in grain and straw were did not significantly influence due to different zero budget natural farming during two years mean (Table 1). The findings indicated that the N, P and K content (%) in grain and straw was the highest under the treatment of T_{15}: 100% RDF (NPK 120:60:40 kg ha^{-1}). However, In general zero budget natural farming, the highest N content in grain and straw was obtained under the treatment of T_{12}: Beejamrutha + Jeevamrutha + Panchgavya (1000 ml + 500 lit + 15 lit. ha^{-1}). On the other hand, the lowest N content in grain and straw was observed under the treatment of T_1: Control. Similarly, the highest content of P and K in grain and straw were obtained under the treatment of T_{12}: Beejamrutha + Jeevamrutha + Panchgavya (1000 ml + 500 lit + 15 lit. ha^{-1}). While, the lowest content of P and K in grain and straw was observed under the treatment of T_1: Control.

Effect on N, P and K uptake by grain and straw (kg ha^{-1})

The data on N, P and K uptake by grain as influenced by different zero budget natural farming during two years mean basis are presented in (Table 1). The different zero budget natural farming significantly influenced the N, P and K uptake by grain (kg ha^{-1}). The comparison of treatments revealed that the significantly maximum N, P and K uptake by grain was noted under the treatment of T_{15}: 100% RDF (NPK 120:60:40 kg ha^{-1}). Although, under zero budget natural farming, the significantly higher N, P and K uptake by grain was recorded under the treatment of T_{12}: Beejamrutha + Jeevamrutha + Panchgavya (1000 ml + 500 lit + 15 lit. ha^{-1}), which being statistically at par to treatments of T_{13}: Beejamrutha + Panchgavya + Ghanajeevamrutha (1000 ml + 15 lit. + 25 kg ha^{-1}), T_{14}: Ghanajeevamrutha + Jeevamrutha + Beejamrutha (25 kg + 500 lit + 1000 ml ha^{-1}), T_9: Jeevamrutha + Panchgavya (500 lit + 15 lit. ha^{-1}), T_7: Beejamrutha + Panchgavya (1000 ml + 15 lit. ha^{-1}), T_6: Beejamrutha + Jeevamrutha (1000 ml + 500 lit ha^{-1}), T_{11}: Panchgavya + Ghanajeevamrutha (15 lit. + 25 kg ha^{-1}) and T_{10}: Jeevamrutha + Ghanajeevamrutha (500 lit + 25 kg ha^{-1}) found to be significantly superior to other treatments. While, the lowest N, P and K uptake by grain was observed under T_1: Control.

Similarly, the significantly higher N, P and K uptake by straw was recorded under the treatment of T_{15}: 100% RDF (NPK 120:60:40 kg ha^{-1}) during two years mean basis. However, in case zero budget natural farming, the treatment of T_{12}: Beejamrutha + Jeevamrutha + Panchgavya (1000 ml + 500 lit + 15 lit. ha^{-1}) registered significantly higher N and K uptake by straw, which was at par to T_{13}: Beejamrutha + Panchgavya + Ghanajeevamrutha (1000 ml + 15 lit. + 25 kg ha^{-1}), T_{14}: Ghanajeevamrutha + Jeevamrutha + Beejamrutha (25 kg + 500 lit + 1000 ml ha^{-1}), T_9: Jeevamrutha + Panchgavya (500 lit + 15 lit. ha^{-1}) and T_7: Beejamrutha + Panchgavya (1000 ml + 15 lit. ha^{-1}). On the other hand, the minimum N, P and K uptake by straw was obtained under the treatment of T_1: Control. The data on K uptake by straw as did not influence by different zero budget natural farming during two years mean**.** Further, more uniform distribution of nutrients near to root zone was added advantage under said treatments for greater absorption of the nutrients and increasing the content in grains and straw. The similar finding has been also reported Sanju (2013) [10], Kumar and Sahu (2013) [5] and Bhagat (2017) [2]. The increase content in grain and straw enhanced dry matter production and subsequently the uptake N, P and K by grains and straw. The higher biomass production might be attributed as the most relevant thinking for higher uptake of nutrients. The same was reported by Binder *et al.* (2000).

Effect on available nitrogen, phosphorus and potassium (kg ha^{-1}) in soil at harvest

The no-significant effect of different treatments was zero budget natural farming during two years means (Table 2). The findings revealed that the highest available nitrogen, phosphorus and potassium (kg ha^{-1}) in soil after the harvest of wheat was obtained under the treatment of T_{15}: 100% RDF (N:P:K 120:60:40 kg ha^{-1}). However, in case of zero budget natural farming, the available nitrogen, phosphorus and potassium in soil after harvest was higher under the treatment of T_{12}: Beejamrutha + Jeevamrutha + Panchgavya (1000 ml + 500 lit + 15 lit. ha^{-1}) followed by T_{13}: Beejamrutha + Panchgavya + Ghanajeevamrutha (1000 ml + 15 lit. + 25 kg ha^{-1}) and T_{14}: Ghanajeevamrutha + Jeevamrutha + Beejamrutha (25 kg + 500 lit + 1000 ml ha^{-1}). The lowest available nitrogen, phosphorus and potassium in soil were observed under the treatment of T_1: Control. Moreover, the

increased root growth as reflected from the dry matter production under said treatments might have also increased these nutrients status in the soil. Available P also increased by the humic substances excreted by root, mineralization and solubilizing effect of soil micro-organisms particularly in presence of CO_2 produced by root. Similarly result findings Ramah (2008) [9].

Table 1: Effect of zero budget natural farming on wheat N, P and K content and uptake in grain and straw

Treatment	N, P and K content (%)						N, P and K uptake (kg ha^{-1})					
	Grain			Straw			Grain			Straw		
	N	P	K	N	P	K	N	P	K	N	P	K
T_1	1.27	0.19	0.30	0.24	0.14	1.25	31.89	4.70	7.50	7.90	4.48	40.91
T_2	1.29	0.22	0.32	0.27	0.17	1.27	37.35	6.36	9.23	9.95	6.62	49.53
T_3	1.30	0.22	0.33	0.28	0.19	1.28	39.32	6.61	9.91	11.44	7.91	53.00
T_4	1.32	0.23	0.34	0.29	0.20	1.29	40.99	7.02	10.69	12.40	8.48	55.14
T_5	1.2 8	0.23	0.31	0.25	0.16	1.26	36.15	6.41	8.67	9.25	6.01	47.29
T_6	1.36	0.22	0.39	0.34	0.24	1.35	50.29	8.25	14.48	17.85	12.74	70.81
T_7	1.36	0.20	0.40	0.35	0.25	1.38	50.68	7.45	15.02	19.75	14.41	78.36
T_8	1.36	0.21	0.39	0.30	0.21	1.31	49.47	7.74	14.13	15.08	10.59	65.30
T_9	1.38	0.23	0.40	0.36	0.26	1.39	51.72	8.60	14.89	20.95	15.26	80.38
T_{10}	1.35	0.23	0.37	0.31	0.22	1.31	49.16	8.29	13.59	15.76	10.95	66.52
T_{11}	1.35	0.25	0.38	0.32	0.23	1.33	49.43	9.04	13.73	16.43	12.07	68.10
T_{12}	1.39	0.27	0.44	0.40	0.39	1.43	53.75	10.50	17.28	24.96	22.51	89.19
T_{13}	1.39	0.26	0.44	0.38	0.38	1.42	52.76	10.00	16.57	22.84	23.07	84.67
T_{14}	1.38	0.25	0.41	0.37	0.32	1.40	52.30	9.57	15.56	22.04	18.61	82.86
T_{15}	1.40	0.30	0.46	0.41	0.50	1.43	57.17	12.16	18.69	27.18	32.58	93.65
S.Em±	0.03	0.03	0.04	0.04	0.11	0.05	1.70	1.17	1.58	1.92	6.74	4.77
CD=0.5%	0.10	0.09	0.13	0.11	0.33	0.16	5.05	3.47	4.69	5.71	20.01	14.18
CV	NS	NS	NS	NS	NS	NS	6.32	NS	20.75	19.69	NS	12.06

Table 2: Effect of zero budget natural farming on wheat available nitrogen, phosphorus and potassium in soil

Treatment	Available nitrogen, phosphorus and potassium in soil (kg ha^{-1})		
	Nitrogen	Phosphorus	Potassium
T_1	130.87	9.59	179.80
T_2	158.76	17.57	220.14
T_3	159.81	17.88	222.10
T_4	159.65	18.15	226.31
T_5	158.31	17.36	218.30
T_6	161.46	18.78	231.63
T_7	162.36	18.86	233.02
T_8	160.60	18.33	226.85
T_9	163.51	18.91	234.64
T_{10}	160.89	18.56	228.26
T_{11}	161.51	18.86	229.75
T_{12}	165.84	20.73	236.91
T_{13}	165.77	19.42	236.66
T_{14}	164.23	19.04	236.45
T_{15}	183.38	27.21	248.70
S.Em±	7.16	2.25	10.88
CD=0.5%	21.26	6.70	32.32
CV	NS	NS	NS

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