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JS Kumbhar

Jr. Economist, AICRP on Integrated Farming System, Deptt. of Agronomy, MPKV, Rahuri, Maharashtra, India

US Surve

Chief Agronomist, AICRP on Integrated Farming System, Deptt. of Agronomy, MPKV, Rahuri, Maharashtra, India

PU Bhosale

Jr. Soil Scientist, AICRP on Integrated Farming System, Deptt. of Agronomy, MPKV, Rahuri, Maharashtra, India

AN Mehetre

SRF, AICRP on Integrated Farming System, Deptt. of Agronomy, MPKV, Rahuri, Maharashtra, India

Influence of fertilizer levels on yield and economics of Pearlmillet-wheat cropping systems in Western Maharashtra

JS Kumbhar, US Surve, PU Bhosale and AN Mehetre

Abstract

In western Maharashtra region the Pearlmillet and Wheat cropping sequence has gained popularity in scarcity zone of Maharashtra state. A Field experiment was conducted on cultivators field during *Kharif* and *Rabi* season of 2017-18 on medium black soil in scarcity zone of Satara district in Western Maharashtra in order to study of Crop response to plant nutrients in Pearlmillet-wheat cropping systems in Western Maharashtra. The field experiment was laid on permanent site in Randomized block design with twenty four replication and seven treatments. The cropping system is more efficient and judicious than individual crop care of the residual effects of nutrients N, P, K and micronutrient. The treatment T₆ comprised of recommended dose of N, P₂O₅ and K₂O (50 kg of N/ha + 25 Kg of P₂O₅ /ha + 25 kg of K₂O/ha for Pearlmillet and 120 kg of N/ha + 60 kg of P₂O₅ /ha + 40 kg of K₂O/ha for wheat) along with micronutrients on soil test basis (25 kg of ZnSO₄/ha for pearlmillet+ 20 kg of ZnSO₄/ha wheat) has obtained significantly higher yield of grain (26.78 q/ha) and straw (42.96 q/ha) of pearlmillet. Such yields of pearlmillet have shown an increase of 35.10 and 52.90 percent respectively over control treatment (T₁). The treatment T₆ has accrued significantly higher yield of wheat grain (33.33 q/ha) and straw (52.01 q/ha) as compared to other treatments, which has indicated an increase grain of 34.28 and straw 54.46 percent over treatment T₁.

Keywords: RDF, micronutrient, pearlmillet-wheat cropping system

Introduction

The Pearlmillet and Wheat cropping sequence has gained popularity in scarcity zone of Western Maharashtra state. Cropping sequence is traditionally a low cost input agriculture system. Information on nutrient management on individual crops is available, while in cropping system it is lacking. Moreover, the single nutrient approach has been replaced by multinutrient to provide balanced nutrient to boost up crop productivity and nutrient use efficiency. In this scarcity zone the soil is also deficit with micronutrient and on the basis of soil sample analysis micronutrients has been added in treatment. Besides nutrient management in cropping system is more efficient and judicious than individual crop, as following crop take care of the residual effects of nutrients N, P, K and micronutrient. The high productivity and low productivity blocks in Phaltan and Khandala, respectively selected for conducting the experiments on farmers field with farmer's participatory approach. Keeping in view the present investigation was undertaken with following specific objectives in order to know the nutrient response of dominant cropping sequence. 1. To find out the response of N, P and K fertilizers on farmers field, 2. To estimate the gross returns, net returns and B:C ratio in respect of selected cropping sequence taken on farmers' field.

Material and Method

The Satara district was purposively selected with intension of carrying out present research on farmers' field in a scarcity zone of western Maharashtra. The two blocks namely Phaltan and Khandala were purposively selected owing to that the production of proposed crops in a selected cropping sequence i.e. Pearl millet in *kharif* and Wheat in *rabi* is relatively higher as compared to other blocks of the district. Three villages each from so selected blocks, thus, in all six villages were also chosen purposely for the study. Four farmers each from these six selected villages, accordingly, twenty four farmers were selected for pearlmillet cultivation in kharif season and wheat crop for rabi season. The details are shown in Table 1 and 2. The data of experiments were collected by cost accounting method with the help of specially designed

Correspondence**JS Kumbhar**

Jr. Economist, AICRP on Integrated Farming System, Deptt. of Agronomy, MPKV, Rahuri, Maharashtra, India

schedule provided by the Director, Farming System Research Project, Modipuram (Uttar Pradesh). The data for the year 2017-18 was collected and estimates were drawn for area under study.

Table 1: Block wise selection of villages from Satara district

District	Block	Name of village
Satara	Phaltan (High productive)	1. Aradgoan
		2. Chawanwadi
		3. Chambharwadi
	Khandala (Low productive)	4. Khed
		5. Sukhed
		6. Nimbodi

The treatments conducted in kharif and rabi seasons are presented in Table 2.

Table 2: Village and seasonwise distribution of selected farmers (2017-18)

Block	Village	Season	
		Kharif	Rabi
Phaltan (High productive)	1. Aradgoan	4	4
	2. Chawanwadi	4	4
	3. Chambharwadi	4	4
Maval (Low productive)	4. Khed	4	4
	5. Sukhed	4	4
	6. Nimbodi	4	4
		24	24

The particulars of treatments conducted in kharif and rabi seasons during 2017-18 are given in

Table 3: Treatments conducted in kharif and rabi seasons of the year under study

Treatments	Pearl millet (RDF 50:25:25)	Wheat (RDF 120:60:40)
T ₁ : Control	No fertilizer	No fertilizer
T ₂ : N	N 50kg/ha	N 120kg/ha
T ₃ : N+P ₂ O ₅	N 50kg/ha+ P-25kg/ha	N 120kg/ha+P 60kg/ha
T ₄ : N + K ₂ O	N 50kg/ha+ K-25kg/ha	N120kg/ha+K 40kg/ha
T ₅ : N+ P ₂ O ₅ +K ₂ O	N 50kg/ha+ P-25kg/ha+ K-25kg/ha	N120kg/ha+P 60kg/ha+K 40kg/ha
T ₆ : N+ P ₂ O ₅ +K ₂ O + MN*	N 50kg/ha+ P-25kg/ha+ K-25kg/h+ Micronutrient as per soil test	N120kg/ha+ P 60kg/ha+ K 40kg/ha + Micronutrient as per soil test
T ₇ : Farmers Practice	As per farmer	As per farmer

Result and Discussion

Influence of treatment of grain yield

The nutrient response was planned on dominant cropping sequence of kharif pearl millet followed by wheat in Phaltan and Khandala block of Satara district and depicted in Table 4.

Table 4: Mean yield of grain and straw of kharif pearl millet and rabi wheat cropping sequence

Treatments	Treatment details	Yield (q/ha)			
		Pearlmillet		Wheat	
		Grain	Straw	Grain	Straw
T ₁	Control (No fertilizers)	19.82	32.47	26.54	41.21
T ₂	Recommended dose of N (50 kg N/ha for pearl millet & 120 kg N/ha for Onion)	21.52 (8.56)	33.72 (6.30)	28.44 (9.58)	44.18 (14.97)
T ₃	Recommended dose of N, P ₂ O ₅ (50 kg N/ha + 25 kg P ₂ O ₅ /ha for pearl millet and 120 kg N/ha + 60 kg P ₂ O ₅ /ha for wheat)	22.67 (14.35)	34.97 (12.60)	30.30 (18.97)	47.12 (29.80)
T ₄	Recommended dose of N, K ₂ O (50 kg N/ha + 25 kg K ₂ O/ha for pearl millet and 120 kg N/ha + 40 kg K ₂ O/ha for wheat)	23.67 (19.42)	40.18 (38.90)	31.36 (24.32)	48.82 (38.41)
T ₅	Recommended dose of N, P ₂ O ₅ and K ₂ O (50 kg N/ha + 25 kg P ₂ O ₅ /ha + 25 kg K ₂ O/ha for pearl millet and 120 kg N/ha + 60 kg P ₂ O ₅ /ha + 40 kg K ₂ O/ha for wheat)	24.79 (25.06)	41.65 (46.30)	32.43 (29.72)	50.58 (47.27)
T ₆	Recommended dose of NPK + Micronutrients (based on soil test) to each of the component crops of cropping system.	26.78 (35.10)	42.96 (52.90)	33.33 (34.28)	52.01 (54.46)
T ₇	Farmer's Practice	21.42 (8.07)	32.82 (1.80)	28.95 (9.08)	43.25 (2.25)
	S. E.+	18.37	69.45	55.98	92.11
	C. D. at 5%	51.360	205.46	141.63	257.57
	C. V.	3.96	9.20	9.21	9.75

[Figures in parentheses indicate percentage increase over Control (T₁)]

It is evident from Table 4 that the treatment differences were found to be significant in case of both kharif Pearl millet and except T₇ rabi wheat. The treatment T₆ comprised of recommended dose of N, P₂O₅ and K₂O (50 kg of N/ha + 25 Kg of P₂O₅/ha + 25 kg of K₂O/ha for pearl millet and 120 kg of N/ha + 60 kg of P₂O₅/ha + 40 kg of K₂O/ha for wheat) along with micronutrients on soil test basis (25 kg of ZnSO₄/ha for pearl millet + 20 kg of ZnSO₄/ha wheat) has obtained significantly higher yield of grain (26.78 q/ha) and straw (42.96 q/ha) of pearl millet. Such yields of pearl millet have shown an increase of 35.10 and 52.90 percent respectively over control treatment (T₁). While the treatment T₆ has

accrued significantly higher yield of wheat grain (33.33 q/ha) and straw (52.01 q/ha) as compared to other treatments, which has indicated an increase grain of 34.28 and straw 54.46 percent over treatment T₁.

Estimation of costs, returns and B:C ratio of crops in selected cropping sequence on farmers' field.

An attempt has been made to estimate the costs, returns and B:C ratio of pearl millet in kharif and wheat in rabi cropping sequence taken on farmers' field. It is apparent from Table 5 that the highest gross returns, net returns and B:C ratio were observed in respect of kharif pearl millet adopting treatment T₆

i.e. recommended dose of N, P₂O₅ and K₂O (50 kg of N/ha + 25 kg of P₂O₅ /ha + 25 kg of K₂O /ha) with micronutrients on soil test basis such as (25 kg of ZnSO₄/ha). The corresponding estimates were ₹43,931.08, ₹36,855.46 and 1.19, respectively. This was followed by Treatments T₅ and

T₄. In case with *rabi* wheat the highest gross returns, cost of cultivation, net returns and B:C ratio were ₹67,800.81, ₹40,010.63 ₹27790.19 and 1.69 in treatment T₆ followed by treatment T₅ and T₂. It is inferred that the treatment T₆ was superior in pearl millet as well as wheat cropping system.

Table 5: Costs, returns and B:C ratio of kharif Pearlmillet-rabi wheat cropping sequence (₹/ha)

Treatment	Kharif Pearlmillet				Rabi Wheat			
	Gross returns	Cost of cultivation	Net returns	B:C ratio	Gross returns	Cost of cultivation	Net returns	B:C ratio
T ₁	32619.79	30307.92	2311.88	1.08	53953	35725.63	18227.38	1.51
T ₂	35180.83	31093.46	4087.38	1.13	57816.5	36955.63	20860.88	1.56
T ₃	36977.10	32264.50	4712.60	1.15	61606.25	41206.88	20399.38	1.50
T ₄	39165.92	33597.08	5568.83	1.17	63772.44	44508.13	19264.31	1.43
T ₅	40949.94	34650.79	6299.15	1.18	65959.69	39390.63	26569.06	1.67
T ₆	43931.08	36855.46	7075.63	1.19	67800.81	40010.63	27790.19	1.69
T ₇	34911	31536.71	1292.83	1.10	58597.5	38466.46	23131.04	1.52
S. E.	327.71	116.731	354.28		1144.59	147.34	1150.41	
C. D.	916.379	326.418	NS		3200.66	412.022	3210.25	
C. V.	4.29	1.74	38.76		9.26	1.85	26.23	

Conclusions

The significantly higher grain and straw yield of kharif pearl millet and rabi wheat were recorded in case of treatment T₆ comprised of N, P₂O₅ and K₂O (50 kg of N/ha + 25 kg of P₂O₅ /ha + 25 kg of K₂O /ha for pearl millet and 120 kg of N/ha + 60 kg of P₂O₅ /ha + 40 kg of K₂O /ha for wheat) with micronutrients on soil test basis such as 25 kg of ZnSO₄/ha for pearl millet + 20 kg of ZnSO₄/ha for wheat. As a result the gross returns, net returns and B:C ratio for these crops were found highest adopting such treatment T₆.

The pearl millet and Wheat cropping sequence gets better yield to plant nutrient response and net returns on farmer's field. Therefore this cropping system is suitable in Phaltan and Khandala blocks of Satara District.

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