



EFFECT OF DIFFERENT NUTRIENT MANAGEMENT AND CROPPING SYSTEM ON WEED INTENSITY, WEED BIOMASS, RICE EQUIVALENT YIELD AND PRODUCTION EFFICIENCY IN DIFFERENT RICE BASED CROPPING SYSTEMS

Megha Dubey*, K. K. Agrawal and Suchi Gangwar

Department of Agronomy, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidhyalaya, Jabalpur - 482 004 (Madhya Pradesh), India.

Abstract

A field experiment was conducted during 2010-11 to 2012-13 at Jabalpur (Madhya Pradesh) to study the effect of nutrient management and cropping system on productivity and soil microbial growth under different rice based cropping systems in Madhya Pradesh. The 4 different cropping systems (CS₁-Green manuring sunhemp-Rice-Wheat, CS₂-Rice-Chickpea-Sesame, CS₃-Rice-Berseem, CS₄-Rice-Veg. pea-Sorghum) and three nutrient managements M₁- 100% Organic (1/3 N through each of FYM, Vermicompost and Neem oil cake), M₂-100% Inorganic (100% NPK through fertilizers), M₃-INM (50% NPK through fertilizer + 50% N through organic sources) with 3 replications in Strip plot design. The soil of the experimental field was sandy clay loam in texture, neutral in reaction (7.3), normal EC (0.52), low in OC (0.72%), medium in available N (264.05kg/ha) and P(12.8 kg/ha) and high in K (285.2 kg/ha). The highest weed intensity of (352.6 m⁻²), weed biomass (1183 kg ha⁻¹), rice equivalent yield (69.35 q ha⁻¹) and production efficiency (22.07 kg ha⁻¹ day⁻¹) during *kharif*, *rabi* and summer season in 100% inorganic nutrient management and rice-berseem cropping system.

Key words : Cropping system, integrated nutrient management, rice and wheat.

Introduction

Rice and wheat are grown in a sequence on an area about 2.7 million hectares in Punjab and contribute 80% in the total food pool of the state of Punjab (DAGP, 2011). Madhya Pradesh is relatively underdeveloped with regards to agricultural productivity rural employment and economic status as compared to most of the Indian states. As it is observed that maximum infestation of weeds is observed in organic nutrient management plots in rice based cropping system. Thus, the severe infestation of weeds resulted in yield reduction as high as 40-60% depending upon the intensity and the type of weed flora (Singh *et al.*, 2003). Thus, it was observed that if we make changes in different nutrient management and cropping systems it will affect the density of weeds. As weeds cause major loss to yield of rice. The organic manures result in increasing the infestation of different weeds in cropping system (Vishwakarma *et al.*, 2012). So, an experiment was carried out to evaluate weed

intensity, weed biomass and rice equivalent yield as affected by organic, inorganic and integrated nutrient management in different rice based cropping systems including oilseeds, pulses, vegetable and fodder crops.

Materials and Methods

The present study was conducted during 2011-12 to 2012-13 at the Research Farm of Jawaharlal Nehru Krishi Vishwa Vidhyalaya, Jabalpur (Madhya Pradesh), India on a sandy clay loam soil. The soil of the experimental site had a pH 7.4, EC 0.51dS/m and organic carbon 0.7%. The available soil nitrogen, phosphorus and potash were 264, 12.6 and 282 kg/ha, respectively. The bulk density of the soil was 1.35 Mg/m³. The factors studied included 3 nutrient management practices *viz.*, organic manure (ONM), chemical fertilizers and integrated nutrient (50:50) (INM) and 4 cropping systems *viz.*, rice-durum wheat-green manuring, rice-chickpea-sesame, rice-berseem (fodder+seed), rice-vegetable pea-sorghum (fodder) in strip plot design with 3 replication. The crop

*Author for correspondence: E-mail: meghadubey33@yahoo.com

Table 1 : Effect of different nutrient management and cropping system on weed intensity (m^{-2}), weed biomass ($kg\ ha^{-1}$), rice equivalent yield ($q\ ha^{-1}$) and production efficiency ($kg\ ha^{-1}\ day^{-1}$) (mean of 2011-12 and 2012-13).

Treatment	Weed intensity / m^2			Weed biomass ($kg\ ha^{-1}$)			Rice equivalent yield ($q\ ha^{-1}$)	Production efficiency ($kg\ ha^{-1}\ day^{-1}$)		
	Kharif	Rabi	Summer	Total	Kharif	Rabi			Summer	Total
M ₁ -100% Organic (1/3 N through each of FYM, Vermicompost and Neem oil cake)	120.2	134.2	98.2	352.6	470	390	323	1183	60.00	19.08
M ₂ -100% Inorganic (100% NPK through fertilizers)	102.3	103.4	67.5	273.2	443	340	302	1085	69.35	22.07
M ₃ -Integrated Nutrient Management (50% through fertilizer + 50% through organic sources)	118.2	120.3	78.1	316.6	459	373	318	1150	66.07	21.03
SEm±	0.12	0.14	0.12	—	0.10	0.12	0.15	—	1.08	0.35
CD (P=0.05)	0.30	0.40	0.30	—	0.30	0.30	0.42	—	2.70	0.87
CS ₁ - Green manuring (sunhemp)-rice (Pusa Sugandha 5)- wheat (MPO 1106)	104.5	134.0	—	238.5	462	341	—	803	63.90	20.16
CS ₂ - Rice (Pusa Sugandha 5)- chickpea (JG 322)- sesame (TKG 55)	99.2	120.5	97.9	317.6	440	398	321	1159	51.74	16.02
CS ₃ - Rice (Pusa Sugandha 5)-berseem (JB 5)	129.2	102.7	—	231.9	568	338	—	906	74.74	26.04
CS ₄ - Rice (Pusa Sugandha 5)-vegetable pea (Arkel)-sorghum (MP Chari)	118.3	106.9	102.3	327.5	523	352	331	1206	70.19	20.70
SEm±	0.13	0.11	0.15	—	1.5	1.4	1.6	—	6.48	2.15
CD(P=0.05)	0.39	0.27	0.42	—	4.6	4.1	4.6	—	16.20	5.37

varieties grown were Pusa sugandha Basmati-5 in rice, MPO-1106 in durum wheat, JG-24 for gram, JB-1 for berseem, Arkel for vegetable pea during winter season and TKG-55 in sesame and MP Chari in sorghum during summer season. These crops were raised with recommended agronomic practices.

In organic manure treatment nutrients were applied through farm yard manure. The manure was applied on the nitrogen equivalent basis for each crop. The nutrient composition of FYM, was 0.5, 0.25, 0.5% N, P₂O₅ and K₂O respectively. For the weed management, mechanical measures were adopted and for insect pest management, neem oil (Azadiractin 0.03%) was applied as and when required under organic nutrient management. In chemical fertilizer treatment, nutrient were applied through chemical fertilizers viz., urea, single super phosphate muriate of potash while plant protection was done through recommended pesticides, when required. The recommended dose of fertilizers for rice, wheat, chickpea, sesame, vegetable pea, sorghum and berseem. 120:26.4:33.3, 120:26.4:33.3, 20:60:30, 30:60:30, 20:26.4:16.6, 100:22:25 and 20:26.4:16.6kg N:P:K/ha.

Results and Discussion

The presence of predominant weed flora was almost similar in all plots, when rice was grown under different rice based cropping system but under 100% organic nutrient management recorded the maximum infestation of weeds. The predominant weed in transplanted rice was *Echinochloa crusgalli* which contributed 39% of the total weed intensity at most critical period 30 DAT. The next predominant weed was *Cyperus iria* with relative density of 33% at 30 DAT. The infestation of *Echinochloa colona* and *Cyperus iria* declined at maturity, while density of other weeds increased. During rabi season *Medicago denticulate* was

found to be more dominant in almost all crops. Its relative density was 42.3, 38.9, 22.8 and 46.9% in wheat, chickpea, berseem and vegetable pea. During summer season *Portulaca oleracea* was most dominating weed in all crops with relative density of 42.7 and 43.6% in sesame and sorghum.

Effect on weed intensity

During the experiment 100% organic nutrient management recorded significantly higher total weed intensity of 352.6 plants m⁻² which was significantly higher than INM (316.6 plants m⁻²) and 100% inorganic nutrient management (273.2 plants m⁻²). The rice-vegetable pea-sorghum cropping system recorded the higher weed intensity of (327.5 m⁻²) and lower in rice-berseem cropping system which recorded the weed intensity of (231.9 plants m⁻²).

Effect on weed biomass

Similarly, higher total weed biomass was recorded in 100% organic nutrient management (1183 kg ha⁻¹) which was significantly higher than integrated nutrient management (1151 kg ha⁻¹) and lowest in 100% inorganic nutrient management (1085 kg ha⁻¹). The rice-berseem cropping system recorded the lower weed biomass of (906 kg ha⁻¹) as compared to all other cropping systems. As berseem is a fodder crop and its growth habit is such that it completely covers the ground and kasni is the only dominant weed which infests berseem crop.

Effect on rice equivalent yield

The weed intensity and weed biomass has influenced the rice equivalent yield (q ha⁻¹) and production efficiency (kg ha⁻¹ day⁻¹) in different rice based cropping systems and reported that 100% inorganic nutrient management recorded (69.35 q ha⁻¹) rice equivalent yield which was at par with INM (66.07 q ha⁻¹) and 100% organic nutrient management (60.00 q ha⁻¹). The rice-berseem cropping system recorded the higher rice equivalent yield of (74.74 q ha⁻¹) followed by rice-vegetable pea-sorghum (70.19 q

ha⁻¹), green manuring-rice-wheat (63.90 q ha⁻¹) and rice-chickpea-sesame (51.74 q ha⁻¹).

Effect on production efficiency

The production efficiency of 100% inorganic nutrient management was the maximum (22.07 kg ha⁻¹ day⁻¹) which was at par with INM (21.07 kg ha⁻¹ day⁻¹) and 100% organic nutrient management (19.08 kg ha⁻¹ day⁻¹). The rice-berseem cropping system recorded the higher production efficiency of (26.04 kg ha⁻¹ day⁻¹) followed by rice-vegetable pea-sorghum (20.70 kg ha⁻¹ day⁻¹), green manuring-rice-wheat (20.16 kg ha⁻¹ day⁻¹) and rice-chickpea-sesame (16.02 kg ha⁻¹ day⁻¹) as also reported by (Upadhyay *et al.* 2011).

Conclusion

The 100% inorganic nutrient management in rice-berseem cropping system recorded the maximum rice equivalent yield and production efficiency and lower weed intensity and weed biomass during both the years.

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