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Correlation and Regression Analysis of Rice-Weed Ecosystem under Rainfed Upland Conditions.

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ABSTRACT

Field experiments were conducted at Agricultural College Farm, Naira for two consecutive kharif seasons of 2005 and 2006 to study the correlation and regression of the grain yield of rice on certain weed and crop parameters under rainfed upland conditions. The results revealed that the grain yield was highly negatively correlated with all the weed parameters except with the density of grasses, sedges and dicots and total weed density at 20 DAS, while the correlation was significantly positive with weed control efficiency. The correlation coefficient between grain yield and all crop parameters were significantly positive except with plant height at 20 DAS, while it was significantly negative with weed index. The regression analysis indicated that there was a negative linear relationship between grain yield and the density of all the three groups of weeds as well as with weed dry weight. The grain yield was reduced by 8.0 kg ha^{-1} with increase of every one gram of weed dry weight per m^2 at 40 DAS.

Key words : Rainfed Upland Rice, Rice-Weed Ecosystem

Upland rice constitutes one of the important ecosystems of the country and its improvement would contribute greatly in meeting future rice demands. Mishra (1999) defined upland rice as the rice grown in fields either bunded or unbunded, flat or sloppy, rainfed, where field preparation and seeding are done under dry conditions and there is no standing water on the soil surface within 48 hours after cessation of rains and there is varying degree of soil moisture stress at different stages of crop. Among the various constraints in realization of enhanced productivity levels under rainfed upland situation, weeds assume a greater menace in rainfed rice culture. The yield loss of rainfed upland rice culture due to the interference of weeds varies from 15 to 50 %. However, the information on the extent of reduction in grain yield due to different groups of weeds in this fragile ecosystem is not available. Therefore, the present investigation was taken up.

MATERIAL AND METHODS

Field experiments were carried out in the upland block of Agricultural College Farm, Naira of Acharya N.G. Ranga Agricultural University for two consecutive kharif seasons of 2005 and 2006. The soils of the experimental site were sandy loam with a pH of 7.2, low in organic C (0.35 %), medium in available P (13.10 kg ha^{-1}) and high in available K (382.2 kg ha^{-1}). The test variety *'Pushkala'* (105 days duration) was sown directly in rows 20 cm apart at 90 kg ha^{-1} in the first fortnight of July in both the years. During the crop growing period, 981.2 mm rainfall in 45 rainy days and 714.4 mm in 41 rainy days was received in 2005 and 2006 respectively. The crop received all the recommended package of practices as and when required except weed management treatments. The experiment comprised of 12 treatments *viz.,* weed free check, weedy check, pre emergence application of pretilachlor @ 1.0 kg *a.i* ha^{-1}, butachlor @1.25 kg *a.i.* ha^{-1}, metsulfuron methyl 10% + chlorimuron ethyl 10%(MMCE) @ 8 g *a.i.* ha^{-1}, oxadiargyl @ 80 g *a.i.* ha^{-1}, working with star weeder at 20&40 DAS, pretilachlor + working with star weeder at 40 DAS, butachlor + working with star weeder at 40 DAS, MMCE + working with star weeder at 40 DAS, oxadiargyl + working with star weeder at 40 DAS and mixing horsegram seed @ 8kg ha^{-1} with the recommended seed rate of rice and incorporating horsegram at 40 DAS . The herbicides were applied with knapsack sprayer fitted with flat fan nozzle using spray volume of 500 L ha^{-1}. The experiment was laid out in randomized block design with three replications. The density and dry weight of weeds were taken at 20 and 40 days after sowing using a quadrate of 0.25 m^2 from four places in each plot. In the treatments where weeding with star weeder was integrated with herbicides, weeding was done after the data on weed parameters was recorded. The

Table 1. Correlation and regression of rainfed upland rice yields on weed and crop characters (Pooled data of 2005-2006)

S. No	Character	Correlation Coefficient (r)	Y= a+ bx
	Grain yield (kg ha^{-1}) *versus*		
I)	**Weed parameters**		
a)	Dry Weight of weeds at 20 DAS (g/m^2)	-0.77**	2354.26 - 17.8 x
b)	Dry Weight of weeds at 40 DAS (g/m^2)	-0.88**	2189.73 - 8.0 x
c)	Density of grasses at 20 DAS (No./m^2)	-0.47	2264.17 - 72.4 x
d)	Density of Sedges at 20 DAS (No./m^2)	-0.19	2238.16 - 71.4 x
e)	Density of dicots at 20 DAS (No./m^2)	-0.47	2389.23 - 116.6 x
f)	Total Weeds density at 20 DAS (No./m^2)	-0.44	2379.99 - 35.2 x
g)	Density of grasses at 40 DAS (No./m^2)	-0.89**	2480.43 - 164.0 x
h)	Density of Sedges at 40 DAS (No./m^2)	-0.86**	2688.18 - 196.1 x
i)	Density of dicots at 40 DAS (No./m^2)	-0.85**	2617.15 - 217.4 x
j)	Total Weeds density at 40 DAS (No./m^2)	-0.60*	2338.55 - 34.3 x
k)	Weed control efficiency (%)	0.88**	882.89+ 13.1x
l)	Weed Index (%)	-0.99**	2420.77 - 23.8 x
II)	**Crop parameters at different stages**		
a)	Plant Height at 20 DAS (cm)	0.55	- 770.21 + 120.8 x
b)	Plant Height at 40 DAS (cm)	0.68*	-2226.45 + 99.4 x
c)	Plant Height at Flowering (cm)	0.97**	-6940.68 + 105.6 x
d)	Total Tillers per Clump (Number)	0.86**	761.38 + 139.8x
e)	Productive Tillers per Clump (Number)	0.83**	909.92 + 145.6x
f)	Panicle Length (cm)	0.88**	-3030.32 + 261.9x
g)	Filled grains per Panicle (Number)	0.88**	-772.98 + 48.3x
h)	Grains Filling (%)	0.96**	-1069.78 + 47.2x
i)	Test weight (g)		-7965.27 + 489.9x
j)	Straw Yield (kg ha^{-1})		-1519.47 + 0.9x

data were computerized and correlation and regression analysis between grain yield and various weed and crop parameters were done by following the standard procedure given by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The study revealed that all the crop parameters except weed index and plant height at 20 DAS were significantly and positively correlated with grain yield, while all the weed parameters except weed control efficiency were negatively correlated with grain yield (Table 1). The correlation coefficient values worked out between grain yield and the density of all the three groups of weeds (grasses, sedges and dicots) and total weed density at 20 DAS were though negative but not significant, while a strong negative correlation was observed for the same at 40 DAS, clearly indicating the exploitive ability of weeds on rainfed upland rice crop with the progression of growth of weeds. A comparatively strong negative relationship was detected between grain yield and weed dry weight than between grain yield and weed density both at 20 and 40 DAS. The increasingly high negative correlation between the grain yield and density of grasses over the density of other two groups of weeds (sedges and dicots) at 40 DAS illustrates the fact that grasses are more competitive to rice followed by sedges and dicots in decreasing order. The significantly high positive correlation between grain yield and weed control efficiency and a very strongly negative correlation between grain yield and weed index reflects the pronounced effect of both these parameters on grain yield and the reliability of these indices for evaluation of the impact of weed control treatments on grain yield of rice.

The regression analysis (Table 1) revealed that the reduction in grain yield could be predicted to the extent of 35.2 kg ha^{-1} with increase of one weed by number per m^2 at 20 DAS, while it was

34.3 kg ha^{-1} at 40 DAS. As regards the predictions pertaining the reduction in grain yield due to the density of individual groups of weeds, it was in the order of 72.4, 71.4, 116.6 kg ha^{-1} at 20 DAS, and 164.0, 196.1 and 217.4 kg ha^{-1} at 40 DAS for grasses, sedges and dicots respectively.

The correlation of grain yield with dry matter accumulation of weeds revealed that a highest negative correlation (- 0.88) was observed at 40 DAS followed by –0.77 at 20 DAS. The reduction in grain yield could be predicted by 17.8 kg ha^{-1} due to the increase of every one gram of weed dry weight at 20 DAS, while it was 8.0 kg ha^{-1} at 40 DAS.

The correlation coefficient of different crop parameters with grain yield indicated that the weed index has highest negative correlation (- 0.99) and plant height at flowering has greatest positive correlation (+0.97) followed by percentage of filled grains (+ 0.96).

Among the different crop parameters, a linear positive increase in grain yield was predicted with total and productive tillers per clump and the increase could be predicted by 139.8 and 145.6 kg ha^{-1} respectively with an increase of one unit of each of these parameters. As regards weed control efficiency, the regression equation predicted a linear increase in grain yield by 13.1 kg ha^{-1} with every one percent increase of this parameter, while incase of weed index, the relationship was negative and could be predicted by a loss of 23.8 kg ha^{-1} in grain yield with an escalation of every unit the index. Similar findings were reported by Ramana Murthy, K.V and Rao, A.S (1997) in summer greengram-weed ecosystem.

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