

Correlation and Regression Analysis of Semidry Rice-Weed Ecosystem

K. Hemalatha, A. V. Ramana, Neha Sharma, Sunil Kumar

Received 10 September 2016; Accepted 12 October 2016; Published online 2 November 2016

Abstract A field experiment was conducted during *khari*, 2014 in sandy loam soils of to study the correlation of the grain yield of rice on certain weed and crop parameters in semidry system of cultivation. The experiment was laid out in a randomized block design with ten treatments, each replicated thrice. The results revealed that the grain yield was highly negatively correlated with all the weed parameters except with density of grasses, sedges and broad leaved weeds as well as total weed density at 30 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 plant height and dry matter production at 30 DAS, while it was significantly negative with weed index. The regression analysis indicated that there was a negative linear relationship between grain yield and density of all the three groups of weeds as well as with weed dry weight.

Keywords Correlation, Regression, Herbicides, Semidry rice, Weeds.

Introduction

Agriculture is the forefront of national and international agenda to assume food security and sound management of natural resources. Cereals play a major role in our food economy and are the most important part of diet throughout the world Mukherjee [1]. Amongst cereals, rice (*Oryza sativa* L.) is the most important and extensively grown in tropical and subtropical regions of the world and is the staple food for more than 60% population of the world. The resources for rice production- land, water, nutrients and labor are becoming increasingly scarce in recent times. Therefore, meeting the rice demand of the burgeoning population is a great challenge in future.

Declining profitability of transplanted rice production system due to increasing production costs and plateauing yield levels have encouraged rice farmers to shift from traditional transplanting to direct seeding. Semidry system of rice cultivation is a unique technique and extensively adopted in more than 20% of rice growing area of our country. In this system,

K. Hemalatha*, N. Sharma, S. Kumar
PhD Research Scholars,
Department of Agronomy,
Institute of Agricultural Sciences, BHU,
Varanasi 221005, Uttar Pradesh, India

A. V. Ramana
Professor and Head,
Department of Agronomy,
Acharya N. G. Ranga Agricultural University,
Agricultural College, Naira 532185,
Andhra Pradesh, India
e-mail : kutikuppalahemalatha@gmail.com
*Correspondence

Table 1. Correlation and regression of semidry rice yields on weed characters.

Sl. No.	Characters	Correlation coefficient (<i>r</i>)	Y = a + bx
Grain yield (kg ha ⁻¹) versus			
Weed parameters			
1	Density of grasses at 30 DAS (No./m ²)	-0.583	6312.81 - 328.1 x
2	Density of sedges at 30 DAS (No./m ²)	-0.507	6990.23 - 1369.1 x
3	Density of broad leaved weeds at 30 DAS (No./m ²)	-0.555	6548.76 - 357.8 x
4	Total weed density at 30 DAS (No./m ²)	-0.777	8539.99 - 453.8 x
5	Density of grasses at 60 DAS (No./m ²)	-0.865**	6791.78 - 339.6 x
6	Density of sedges at 60 DAS (No./m ²)	-0.830**	7009.59 - 1197.5 x
7	Density of broad leaved weeds at 60 DAS (No./m ²)	-0.955**	6898.36 - 458.6 x
8	Total weed density at 60 DAS (No./m ²)	-0.958**	7192.41 - 300.3 x
9	Density of grasses at harvest (No./m ²)	-0.837**	6748.62 - 371.7 x
10	Density of sedges at harvest (No./m ²)	-0.795**	7803.39 - 1740.3 x
11	Density of broad leaved weeds at harvest (No./m ²)	-0.944**	7185.83 - 511.5 x
12	Total weed density at harvest (No./m ²)	-0.951**	7417.51 - 347.4 x
13	Dry weight of grasses at 30 DAS (g/m ²)	-0.840**	7042.18 - 433.7 x
14	Dry weight of sedges at 30 DAS (g/m ²)	-0.788**	6945.06 - 1030.4 x
15	Dry weight of broad leaved weeds at 30 DAS (g/m ²)	-0.723*	6819.25 - 404.9 x
16	Total weed dry weight at 30 DAS (g/m ²)	-0.823**	7254.74 - 318.3 x
17	Dry weight of grasses at 60 DAS (g/m ²)	-0.815**	6248.04 - 346.4 x
18	Dry weight of sedges at 60 DAS (g/m ²)	-0.805**	5933.37 - 694.4 x
19	Dry weight of broad leaved weeds at 60 DAS (g/m ²)	-0.972**	6835.56 - 473.6 x
20	Total weeds dry weight at 60 DAS (g/m ²)	-0.965**	6874.67 - 311.8 x
21	Dry weight of grasses at harvest (g/m ²)	-0.824**	6564.78 - 412.7 x
22	Dry weight of sedges at harvest (g/m ²)	-0.861**	6852.22 - 992.1 x
23	Dry weight of broad leaved weeds at harvest (g/m ²)	-0.969**	7388.74 - 521.2 x
24	Total weed dry weight at harvest (g/m ²)	-0.955**	7344.91 - 311.8 x
25	Weed control efficiency at 60 DAS	0.897**	1538.98 + 47.0 x
26	Weed control efficiency at harvest	0.885**	1550.80 + 48.7 x
27	Weed index	-0.967**	5780.64 - 63.9 x
28	Weed management index	0.781**	-3168.88 + 6949.4 x

the early growth of rice, up to 30–40 days is in dry soil environment and thereafter comes under submergence with the release of canal water after stabilization of south-west monsoon. Absence of stagnant water during the initial 4–6 weeks causes serious problems in dry sown low land rice with regard to weed management, affecting its productivity adversely. Adoption of direct-seeded rice has resulted in a change in the relative abundance of weed species in rice crop. Therefore, the present investigation was taken up to establish an empirical relationship between weed as well as crop parameters on the yield of rice grown under semidry ecosystem.

Materials and Methods

A field experiment was conducted during *kharif*, 2014 at the Agricultural College, Naira, Andhra Pradesh.

The soil was sandy loam in texture with a pH of 6.5 and EC of 0.15 dSm⁻¹, low in organic carbon (0.33%) and available nitrogen (174 kg ha⁻¹), medium in available phosphorus (38 kg ha⁻¹) and potassium (264 kg ha⁻¹). Rice variety 'Vijetha' was sown by using line markers at 20 cm row spacing with solid rows at a seed rate of 75 kg ha⁻¹ on 26th July, 2014. The plot size was 6 m × 4 m. During the crop growing period, 723.9 mm of rainfall was received in 36 rainy days. The experiment was laid out in randomized block design with three replications. The treatments consisted of ten different weed management practices viz., T₁: Weedy check, T₂: Hand weeding twice at 20 and 40 DAS (weed free check), T₃: Pendimethalin @ 0.75 kg a.i. ha⁻¹ as pre-emergence application at 3–5 DAS, T₄: Orthosulfamuron @ 100 g a.i. ha⁻¹ as pre-emergence application at 3–5 DAS, T₅: Orthosulfamuron @ 100 g a.i. ha⁻¹ as post-emergence application at 20–25 DAS,

Table 2. Correlation and regression of semidry rice yields on crop characters.

Sl. No.	Characters	Correlation coefficient (<i>r</i>)	Y = a + bx
Grain yield (kg ha ⁻¹) versus Crop parameters			
1	Plant height at 30 DAS (cm)	0.455	-4872.65 + 240.0 x
2	Plant height at 60 DAS (cm)	0.910**	-14301.91 + 226.7 x
3	Plant height at 90 DAS (cm)	0.988**	-11252.15 + 173.4 x
4	Plant height at harvest	0.981**	-8880.33 + 140.7 x
5	Dry matter production at 30 DAS	0.442	501.42 + 2.5 x
6	Dry matter production at 60 DAS	0.986**	-8493.36 + 2.1 x
7	Dry matter production at 90 DAS	0.961**	-7347.82 + 1.1 x
8	Dry matter production at harvest	0.967**	-5679.95 + 0.9 x
9	Total tillers at 60 DAS	0.975**	-1429.87 + 24.6 x
10	Total tillers at 90 DAS	0.983**	-853.62 + 19.1 x
11	Total tillers at harvest	0.988**	-830.51 + 19.3 x
12	Productive tillers	0.985**	-395.56 + 17.9 x
13	Number of filled grains panicle ⁻¹	0.954**	-3074.09 + 58.0 x
14	Panicle length	0.986**	-14489.89 + 836.6 x
15	Test weight	0.897**	-29023.36 + 1543.0 x
16	Straw yield	0.992**	-1004.58 + 0.9 x
17	Harvest index	0.935**	-22032.700 + 624.3 x

T₆; Ethoxysulfuron @ 20 g a.i. ha⁻¹ post-emergence application at 20–25 DAS, T₇; Metsulfuron methyl + Chlorimuron ethyl @ 4 g a.i. ha⁻¹ as post-emergence application at 20–25 DAS, T₈; T₃ followed by T₅, T₉; T₃ followed by T₆, T₁₀; T₃ followed by T₇. The herbicides were applied with knapsack sprayer; using spray volume of 500 l ha⁻¹. The crop was harvested on 2nd December, 2014.

The density and dry weight of weeds were taken at 30, 60 DAS and at harvest in each plot using a quadrat of 0.25 m². The data were computerized and correlation and regression analysis between grain yield and various weed and crop parameters were done by following the standard procedure. Weed Management Index (WMI) was calculated by using the formula suggested by Devasenapathy et al. [2].

$$\text{WMI} = \frac{\% \text{ of crop yield over control}}{\% \text{ of control of weeds}}$$

Results and Discussion

The study revealed that all crop parameters were positively correlated with grain yield, while all the weed

parameters except weed control efficiency at 60 DAS and harvest were negatively correlated with grain yield (Table 1). The correlation coefficient values worked out between grain yield and density of all the three groups of weeds (grasses, sedges and broad leaved weeds) and total weed density at 20 DAS were though negative but not significant, where as a strong negative correlation was observed for the same at 60 DAS and harvest, clearly indicating the exploitive ability of weeds in semidry rice with the progression of growth of weeds. A comparatively strong negative relationship was detected between grain yield and weed dry weight at 30 and 60 DAS and at harvest. Significantly high positive correlation between grain yield and weed control efficiency as well as weed management index and a very strongly negative correlation between grain yield and weed index reflects the marked 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 semidry rice.

The regression analysis (Table 1) revealed that the reduction in grain yield could be predicted to the extent of 453.8 kg ha⁻¹ with increase of one weed by number per m² at 30 DAS, while it was 300.3 and 347.4

kg ha⁻¹ at 60 DAS and harvest respectively. As regards the predictions pertaining the reduction in grain yield due to density of individual groups of weeds, it was in the order of 328.1, 1369.1, 357.8 kg ha⁻¹ at 30 DAS, 339.6, 1197.5, 458.6 kg ha⁻¹ at 60 DAS and 371.7, 1740.3, 511.5 kg ha⁻¹ at harvest for grasses, sedges and broad leaved weeds respectively.

The correlation of grain yield with dry matter accumulation of weeds revealed that a highest negative correlation (-0.965) was observed at 60 DAS followed by -0.955 at harvest and -0.823 at 30 DAS. The reduction in grain yield could be predicted by 318.3 kg ha⁻¹ due to the increase of every one gram of weed dry weight at 30 DAS, while it was 311.8 and 311.8 kg ha⁻¹ at 60 DAS and harvest respectively, indicating the importance of early weeding in semidry rice.

The correlation coefficient of different crop parameters with grain yield indicated that the weed index has the highest negative correlation (-0.967) and straw yield has greatest positive correlation (0.992) followed by total tillers at harvest (0.988) and panicle length (0.986). Similar observations were recorded by Jacob and Syriac [3] and Hashem Aminpanah [4].

Among the different crop parameters (Table 2), a positive and linear increase in grain yield was predicted with total (19.3 kg grain ha⁻¹) and productive (17.9 kg grain ha⁻¹) tiller m² with an increase of one

unit of each of these parameters. As regards weed control efficiency at 60 DAS and at harvest, the regression equation predicted a linear increase in grain yield by 47.0 and 48.5 kg ha⁻¹ with every one percent increase of this parameter, while in case of weed index, the relationship was negative and could be predicted by a loss of 63.9 kg ha⁻¹ in grain yield with an escalation of every unit the index. Similar findings were reported by Ramana et al. [5]. Thus, it is concluded that in semidry system of rice cultivation, controlling weed population at critical stage reduces weed dry matter accumulation, increases weed control efficiency and weed management index which in turn increases yield attributes and consequently grain yield of semidry rice.

References

1. Mukherjee D (2006) Weed management strategy in rice – a review. *Agric reviews* 27 : 247–257.
2. Devasenapathy P, Ramesh T, Gangwar V (2008) Weed management studies. Inefficiency indices for agricultural management research, pp 55–64.
3. Jacob D, Elizabeth Syriac K, Pushpakumari R (2005) Spacing and weed management in transplanted basmati rice. *Madras Agric J* 92 : 224–229.
4. Hashem Aminpanah (2014) Effect of crop density and reduced rates of pretilachlor on weed control and grain yield in rice. *Romanian Agric Res* No. 31.
5. Ramana AV, Ramana Murthy KV, Joginaidu G (2008) Correlation and regression analysis of rice under rainfed upland conditions. *The Andhra Agric J* 55 : 273–275.