

## COMPETITION FOR NUTRIENTS BY RICE AND WEEDS\*

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Weeds reduce crop yields by competing with the crop for water, nutrients light and space. When two or more organisms draw their nourishment from a source and when the nutrients get reduced, competition begins. In lowland paddy where water is not a limiting factor, crop and weeds compete primarily for nutrients, light and space. Rao (1966) observed that competition between crop and weeds was more for nutrients than for water and light. Earlier studies by Shetty and Gill (1974), Sankaran and Mani (1975), Ravindran (1976) and Balu (1977) revealed that the weeds removed substantial quantities of nutrients at the expense of the crop. The present study of the competition of paddy crop and weeds for the three major nutrients, N, P & K was taken up to ascertain the extent of nutrient uptake.

### Materials and Methods

The present investigation was conducted at the College of Agriculture, Vellayani, Kerala during the second crop season 1976 using a short duration rice variety, *Triveni*. Hand weeding was done to keep weed free conditions of 10, 20 and 30 day periods upto 60th day after transplanting. There was one unweeded control plot and another one weeded throughout upto 60th day. The experiment was laid out in randomised block design and replicated thrice.

Twenty day old seedlings were transplanted at a spacing of 15 x 10 cm. Fertilizers were applied at the rate of 70:35:35 kg N,  $P_2O_5$  and  $K_2O$ /ha. Full P and K and 2/3rd N were applied as basal and 1/3rd N was applied 30 days after transplanting. Weed seeds of *Echinochloa crus-galli* were broadcast at the rate of 5 g/plot (6 x 4 m) for uniform weed stand.

The weed samples were removed just before weeding and once at harvest and were analysed for N, P and K. The crop samples were analysed for N, P and K at harvest only. The uptake of N, P and K by both crop and weeds in kg/ha was worked out and P and K were expressed as  $P_2O_5$  and  $K_2O$  respectively.

### Results and Discussion

#### *Nutrient uptake by weeds*

Among the 10 day periods, weeding between 21-30 days after transplanting ( $T_3$ ) was found to be the best time in reducing the uptake of the three major nutrients by weeds. The uptake of N,  $P_2O_5$  and  $K_2O$  in plot weeded 21 -30 days was on par with longer weed free periods except in plots where weeding started after 40th day of transplanting ( $T_5$ ,  $T_6$  and  $T_{11}$ ). Weeds in unweeded check removed 24.0 kg N, 7.9 kg  $P_2O_5$  and 30.5 kg  $K_2O$ /ha. Nutrient uptake by weeds in unweeded

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check indicates that maximum N,  $P_2O_5$  and  $K_2O$  uptake occurred during 31-40 days, considering the 10 day periods, the corresponding percentages being 37.5, 42.0 and 40.4, respectively (Table 2). In unweeded check more than 50 per cent of nutrient uptake occurred by 40th day. It is also interesting to note that in general the rate of uptake after 40th day got reduced, indicating that the competition was severe during 21-40 days even though it continued upto harvest (Table 1).

### Nutrient uptake by crop

#### Nitrogen

The least uptake of N (57.4 kg/ha) by rice crop was in plot weeded during 51-60 days indicating that the weeds offered competition for N upto 50th day of transplanting. The uptake of N by rice crop in unweeded check (57.5 kg N/ha) was on par with plot weeded very early (1-10 days) and plot weeded late (51-60 days) after 50th day. This indicates that crop and weed compete for N during 11-50 days.

Table 1  
Effect of different periods of weed removal on total nutrient uptake by crop and weed (kg/ha)

Treatments (Weedfree days after transplanting)		Nitrogen		$P_2O_5$		$K_2O$	
		Crop	Weed	Crop	Weed	Crop	Weed
T <sub>1</sub>	1-10	59.9	23.8	28.3	7.8	75.4	27.9
T <sub>2</sub>	11-20	67.9	12.1	28.9	4.3	88.3	18.2
T <sub>3</sub>	21-30	74.7	4.9	34.0	1.9	102.5	7.0
T <sub>4</sub>	31-40	77.5	7.0	34.7	2.7	102.5	11.8
T <sub>5</sub>	41-50	70.4	15.3	33.2	5.6	83.8	24.4
T <sub>6</sub>	51-60	57.4	18.5	28.6	6.3	70.2	27.6
T <sub>7</sub>	1-20	71.0	12.1	29.3	4.4	88.9	16.1
T <sub>8</sub>	11-30	73.4	3.8	34.6	1.4	99.3	3.9
T <sub>9</sub>	21-40	85.3	3.2	37.7	1.2	111.1	5.2
T <sub>10</sub>	31-50	83.7	6.9	38.6	2.5	105.4	13.1
T <sub>11</sub>	41-60	63.4	14.9	32.5	5.4	85.1	13.9
T <sub>12</sub>	1-30	78.4	3.5	35.9	1.4	98.8	5.4
T <sub>13</sub>	11-40	88.6	2.3	39.2	0.9	104.6	3.2
T <sub>14</sub>	21-50	86.1	2.3	37.3	0.9	105.6	4.4
T <sub>15</sub>	31-60	76.1	6.2	36.0	2.3	89.4	13.0
T <sub>16</sub>	weedy check	57.5	24.0	28.4	7.9	70.0	30.5
T <sub>17</sub>	1-60	83.7	0.3	40.4	0.1	109.5	0.5
CD	(0.05)	9.27	7.59	4.95	1.22	8.44	6.23

Table 2  
Pattern of nutrient uptake by weeds in unweeded check ( $T_{16}$ ), kg ha

Days after transplanting	Nitrogen	$P_2O_5$	$K_2O$
10th	0.0	0.0	0.0
20th	1.1	0.5	3.6
30th	5.4	2.0	11.0
40th	14.4	5.3	23.3
50th	17.9	6.2	27.4
60th	21.2	6.9	29.7
At harvest (80th)	24.0	7.9	30.5

Table 3  
Values of simple correlation coefficients

Sl. No.	Characters correlated	Correlation coefficient
1	Grain yield x N uptake by weeds	-0.74**
2	Grain yield x $P_2O_5$ uptake by weeds	-0.84**
3	Grain yield x $K_2O$ uptake by weeds	-0.80**
4	N uptake by crop x N uptake by weeds	-0.79**
5	$P_2O_5$ uptake by crop x $P_2O_5$ uptake by weeds	-0.70**
6	$K_2O$ uptake by crop x $K_2O$ uptake by weeds	-0.90**

\*\* Significant at 0.01 level

Table 4  
Grain yield in kg/ha

Treatments Yield	$T_1$ 2636	$T_2$ 2920	$T_3$ 3248	$T_4$ 3175	$T_5$ 2818	$T_6$ 2599	$T_7$ 3066	$T_8$ 3208
Treatments Yield	$T_9$ 3307	$T_{10}$ 3224	$T_{11}$ 2966	$T_{12}$ 3314	$T_{13}$ 3383	$T_{14}$ 3406	$T_{15}$ 3175	$T_{16}$ 2533
Treatments Yield	$T_{17}$ 3466	C. D. (0.05) = 326.7						

It may also be noted that the crop has absorbed a maximum quantity of 88.6 kg N/ha from plot weeded 11—40 days after transplanting. The uptake by rice in plot weeded 1-60 days (83.7 kg N/ha) was on par with plots receiving weeding

for 10 or 20 days during 21-40 days. This shows that eventhough the competition for nitrogen was between 11-50 days, the severity was noted between 21-40 days. Mikkelson's (1970) finding is also on similar lines.

### Phosphorus

The least uptake of phosphorus by crop (28.3 kg  $P_2O_5$ /ha) was in plot weeded 1-10 days followed by unweeded check ( $T_{16}$ ) with 28.4 kg  $P_2O_5$ /ha. The uptake by crop in unweeded check was on par with early weeded plots i.e., weeded upto 20th day after transplanting ( $T_1$   $T_2$   $T_7$ ) and those in plots weeded after 40th day ( $T_5$   $T_6$   $T_{11}$ ) indicating that rice and weeds compete for  $P_2O_5$  during 21-40 days after transplanting.

Plots weeded 1-60 days recorded maximum  $P_2O_5$  uptake by crop (40.4 kg/ha) and was on par with uptake in plot weeded 21-40 days ( $T_9$ ). This also confirms that rice and weeds compete for phosphorus during 21-40 days. This is in agreement with the finding of Mikkelson (1970).

### Potassium

The least uptake of potassium by crop was in weedy check (70.0 kg  $K_2O$ /ha) which was on par with plots weeded before 10th ( $T_1$ ) and after 51st ( $T_6$ ) days of transplanting. This indicates that the crop and weed competed for potash during 11-50 days.

Plots weeded 21-40 days recorded maximum potassium uptake of 111.1 kg  $K_2O$ /ha by the crop. The uptake of potassium in plots weeded 1-60 days (109.5 kg  $K_2O$ /ha) was on par with those of plots receiving a minimum of 10 days weeding during 21-40 days.

It may be noted that, in general, weeding done before 20th or after 40th day of transplanting alone did not reduce the uptake of nutrients by weed. The demand for each nutrient by crop and weed was in the order  $K > N > P$ . Shetty and Gill (1974) also got similar trend in nutrient uptake.

The nutrient uptake by weed (N,  $P_2O_5$  and  $K_2O$ ) was negatively correlated with grain yield. Balu (1977) also got similar results. Grain yield reductions per kg of N,  $P_2O_5$  and  $K_2O$  absorbed by weeds in unweeded check were 39.2, 117.9 and 30.6 kg/ha respectively (Table 4). The N,  $P_2O_5$  and  $K_2O$  uptake values by weeds were negatively correlated with N,  $P_2O_5$  and  $K_2O$  uptake by crop. Sankaran and Mani (1975) got similar results in sorghum. The N,  $P_2O_5$  and  $K_2O$  uptake by weeds constituted 20.5, 21.8 and 30.3 per cent of the total removal of each nutrient by crop plus weed in unweeded check. The weeds in unweeded check were able to reduce the crop uptake by 26.2, 12.0 and 39.4 kg/ha of N,  $P_2O_5$  and  $K_2O$  respectively compared to the plot weeded 1-60 days.

### Summary

In an experiment to study the crop weed competition for 3 major nutrients in a short duration rice, carried out at the College of Agriculture, Vellayani, it was found that in general competition for the three nutrients N, P and K was severe between 21-40 days after transplanting. Weed removal during 21-30 days helped the crop to absorb more of the nutrients. The demand for the nutrients was in the order of  $K > N > P$  by crop and weed. The nutrient uptake by weed was negatively correlated with crop yield while the uptake by weed and crop were also negatively correlated.

### സംഗ്രഹം

ശ്രീവേണി ഇനം നെല്ല് നട്ട് 21 മുതൽ 40-ാം ദിവസം വരെയുള്ള കാലയളവിൽ പാക്യജനകം, ഭാവാഹം, ക്ഷാരം എന്നീ പ്രധാനപ്പെട്ട മൂന്നു പോഷക മൂലകങ്ങൾക്കുവേണ്ടി നെല്ല് കളയും തമ്മിൽ ഏറ്റവും വലിയ  $\text{ffiroi}^{\circ}(\text{TUfOo}$ . നടക്കുന്നതായി വെള്ളായണി കാർഷികകോളജിൽ നടത്തിയ പരീക്ഷണങ്ങൾ തെളിയിക്കുന്നു. നട്ട്, മുപ്പത് ദിവസത്തിന് മുമ്പ് കളയെടുക്കുന്നത് കൂടുതൽ വളം വലിച്ചെടുക്കാൻ നെല്ലിനെ സഹായിക്കുന്നതായും തന്ത്സിലാക്കി.

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