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**Short communication**

# Nutrient uptake by rice and weeds as influenced by different weed management practices in dry-seeded rice

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Rice cultivation by direct-seeding is viewed as both cost and labor saving practice and becoming popular alternative to transplanting in some regions of Asia. Compared to transplanted rice, under direct-seeding, weeds have been found to be the biggest biological constraint because they emerge simultaneously with rice seedlings (Rao and Nagamani 2013). Ninty per cent loss in grain yield due to weeds in direct-seeded rice was reported by Zahoor *et al*. (2014). The yield losses in direct-seeded rice may range from 10 to 100% depending on type of weed flora, their density and duration of competition (Rao *et al*. 2007). In this context, the present investigation was carried out to study the effect of weed management practices on nutrient uptake of weeds and crop.

A field experiment was conducted during *Kharif*, 2014 at the Agricultural College, Naira, Andhra Pradesh. The soil was sandy loam in texture with a $p^H$ of 6.5 and EC of 0.15 dS/m, low in organic carbon (0.33%) and available nitrogen (174 kg/ha), medium in available phosphorus (38 kg/ha) and potassium (264 kg/ha). Rice variety '*Vijetha¼*' was sown by using line markers at 20 cm row spacing with solid rows with a seed rate of 75 kg/ha on 26$^{th}$ July, 2014. During the crop growing period, 723.9 mm rainfall in 36 rainy days was received. The plot size was 6 x 4 m. The experiment was laid out in randomized block design with three replications. The treatments consisted of ten weed management practices (**Table 1**), The herbicides were applied with knapsack sprayer; using spray volume of 500 l/ha. The crop was harvested on 2$^{nd}$ December, 2014.

A recommended dose of 120 kg N, 60 kg P, and 50 kg K/ha was applied through urea, single superphosphate and muriate of potash, respectively. Nitrogen was applied in three equal splits. Entire quantity of phosphorus was applied as basal at the time of sowing. Potassium was applied in two splits ½ as basal at the time of sowing and ½ at panicle initiation stage along with urea. The plant samples of rice utilized for recording dry matter production at harvest and weed samples at 60 DAS were ground in a Willey mill to pass through 40 mesh sieve. The ground material was collected in butter paper bags and later used for chemical analysis. Nitrogen and phosphorus were estimated by micro Kjeldahl's method (Jackson 1973), Vanado molybdate phosphoric yellow colour method (Jackson 1973), respectively. Potassium was determined by Flame photometer method (Jackson 1973) and it was expressed in per cent.

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## Weed flora

Eleven weed species that belong to seven different families were recorded in the experimental field. Among them, *Echinochloa colona*, *Echinochloa crus-galli* and *Cynodon dactylon* were grasses, *Cyperus rotundus, Cyperus difformis, Fimbristylis miliaceae* were sedges while, *Eclipta alba, Ludwigia parviflora, Ammania baccifera, Euphorbia hirta, Trianthema portulacastrum* were broad-leaved weeds. However, *Echinochloa colona* and *Echinochloa crus-galli* among grasses, *Cyperus rotundus* among sedges and *Eclipta alba* and *Ludwigia parviflora* among broad-leaved were dominant throughout the crop growth period.

## Effect on weeds

Pre-emergence (PE) application of pendimethalin 0.75 kg/ha *fb* metsulfuron-methyl + chlorimuron-ethyl 4 g/ha as post-emergence (PoE) registered the lowest total weeds biomass and was comparable with weed free check. Sequential application of pendimethalin *fb* metsulfuron-methyl + chlorimuron-ethyl was found to be highly efficacious in reducing total weed biomass at harvest (**Table 1**). Pre-emergence application of pendimethalin *fb* PoE application of metsulfuron-methyl + chlorimuron-ethyl registered the highest weed control efficiency (89.7%), which was comparable with weed free check (90.6%). The highest weed control efficiency

might be attributed to successive application of two herbicides at an interval of 20 days resulting in reduction in total weed biomass which was comparable with weed free check.

Significantly lower values (0.1%) for weed index were recorded with PE application of pendimethalin 0.75 kg/ha at 3-5 DAS *fb* PoE application of metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 20-25 DAS, which was comparable with weed free check indicating its superiority compared to rest of the weed control treatments as well as weedy check. Pre-emergence application of pendimethalin 0.75 kg/ha at 3-5 DAS registered significantly higher values for weed index (44.1%) while weedy check registered the highest weed index (63.5%) among all the weed control treatments studied.

**Effect on crop yield**

Maximum grain and straw yield was obtained with the application of pendimethalin *fb* metsulfuron-methyl + chlorimuron-ethyl and was comparable with weed free check. Harvest index did not vary to a statistically perceptible magnitude. Prevalence of weed free crop growing environment might have enabled congenial conditions for higher crop growth and higher yields in PE application of pendimethalin 0.75 kg/ha *fb* metsulfuron-methyl + chlorimuron-ethyl 4 g/ha as PoE, on par with weed free check.

**Nutrient uptake by crop**

Among the herbicides, the highest uptake of nitrogen by grain was registered with the application of pendimethalin 0.75 kg/ha as PE *fb* metsulfuron-methyl + chlorimuron ethyl 4 g/ha as PoE and was found parity with pendimethalin 0.75 kg/ha as PE *fb* orthosulfamuron 100 g/ha as PoE application and orthosulfamuron 100 g/ha as PE application as well as weed free check. Uptake of phosphorus by grain also showed similar trend as that of the uptake of nitrogen. Uptake of potassium by grain also showed similar trend as that of the uptake of nitrogen by grain except that pendimethalin 0.75 kg/ha as PE application *fb* orthosulfamuron 100 g/ha as PoE application was comparable only with pendimethalin 0.75 kg/ha as PE application *fb* ethoxysulfuron 20 g/ha PoE application.

Among the herbicides tried, pendimethalin 0.75 kg/ha as PE *fb* metsulfuron methyl + chlorimuron ethyl 4 g/ha as PoE registered significantly higher nitrogen uptake by straw which was comparable with pendimethalin 0.75 kg/ha as PE at 3-5 DAS *fb* orthosulfamuron 100 g/ha as PoE at 20-25 DAS as well as weed free check. Similar trend as noticed with the uptake of nitrogen by straw was also observed with the uptake of phosphorus by straw except that weedy check was comparable with pendimethalin 0.75 kg/ha as PE, orthosulfamuron 100 g/ha and ethoxysulfuron 20 g/ha PoE application at 20-25 DAS and significantly inferior to rest of the treatments. Uptake of potassium by straw followed same trend as noticed with the uptake of phosphorus by straw.

Higher uptake of N, P and K by grain and straw comparable to weed free check was observed with pendimethalin 0.75 kg/ha as PE *fb* metsulfuron-methyl + chlorimuron ethyl 4 g/ha as PoE, pendimethalin 0.75 kg/ha as PE at 3-5 DAS *fb* orthosulfamuron 100 g/ha as PoE and orthosulfamuron 100 g/ha as pre-emergence. Higher values for the uptake of N, P and K by crop under relatively weed free crop growing conditions was also observed earlier (Sandyarani *et al*. 2013).

**Nutrient uptake by weeds**

Significantly higher quantity of nitrogen uptake by weeds was noticed in weedy check treatment

**Table 1. Effect of weed management practices on weed density, weed control efficiency, weed index and yield of semidry rice**

| Treatment | Total weed biomass (g/m) | Total weed density (no./m) | Weed control efficiency (%) | Weed index (%) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|
| Pendimethalin 750 g/ha as PE at 3-5 DAS | 11.0(121.3) | 12.8(163.2) | 49.6(58.0) | 41.6(44.1) | 3.02 | 4.70 |
| Orthosulfamuron 100 g/ha as PE at 3-5 DAS | 7.1(49.7) | 7.0(48.9) | 65.7(83.1) | 17.0(8.6) | 4.94 | 6.46 |
| Orthosulfamuron 100 g/ha as PoE at 20-25 DAS | 9.3(86.6) | 12.7(160.4) | 56.2(69.1) | 36.4(35.2) | 3.50 | 5.02 |
| Ethoxysulfuron 20 g/ha PoE at 20-25 DAS | 8.8(77.3) | 12.2(149.6) | 57.7(71.4) | 30.6(26.0) | 4.00 | 5.69 |
| Metsulfuron-methyl + chlorimuron-ethyl 4 g/ha as PoE at 20-25 DAS | 8.4(69.4) | 11.7(136.6) | 61.7(77.4) | 27.7(21.7) | 4.23 | 5.71 |
| Pendimethalin 0.75 kg/ha as PE *fb* orthosulfamuron 100 g/ha as PoE | 7.4(54.9) | 7.5(55.2) | 65.6(82.9) | 20.5(12.7) | 4.71 | 6.24 |
| Pendimethalin 0.75 kg/ha as PE *fb* ethoxysulfuron 20 g/ha PoE | 7.5(56.0) | 8.1(65.2) | 62.7(78.9) | 21.4(13.3) | 4.68 | 6.28 |
| Pendimethalin 0.75 kg/ha as PE *fb* metsulfuron-methyl + chlorimuron-ethyl 4 g/ha as PoE | 6.5(41.3) | 6.1(37.5) | 71.3(89.7) | 1.8(0.1) | 5.40 | 6.97 |
| Hand weeding twice at 20 and 40 DAS (weed free check) | 6.4(40.0) | 6.0(35.7) | 72.1(90.6) | - | 5.40 | 6.97 |
| Weedy check | 16.2(261.9) | 16.1(259.9) | - | 52.8(63.5) | 1.97 | 3.05 |
| LSD (P=0.05) | 0.4 | 2.2 | 4.5 | 4.3 | 0.345 | 0.55 |

Data were subjected to arc sine transformation. Figures in parentheses are original values; DAS - Days after sowing

**Table 2. Effect of weed management practices on uptake of N, P and K by grain, straw and weeds at 60 DAS of semi-dry rice**

| Treatment | Grain (kg/ha) | | | Straw (kg/ha) | | | Weeds at 60 DAS (kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | P | K | N | P | K | N | P | K |
| Pendimethalin 750 g/ha as PE at 3-5 DAS | 38.3 | 14.3 | 27.5 | 24.5 | 12.4 | 84.7 | 10.3 | 4.2 | 10.5 |
| Orthosulfamuron 100 g/ha as PE at 3-5 DAS | 51.1 | 19.6 | 37.9 | 38.8 | 19.9 | 111.0 | 3.8 | 1.7 | 4.3 |
| Orthosulfamuron 100 g/ha as PoE at 20-25 DAS | 38.8 | 14.7 | 28.2 | 24.4 | 12.8 | 86.9 | 8.4 | 3.8 | 8.2 |
| Ethoxysulfuron 20 g/ha PoE at 20-25 DAS | 42.2 | 15.9 | 30.1 | 27.1 | 13.5 | 89.9 | 7.1 | 3.3 | 7.6 |
| Metsulfuron-methyl + chlorimuron-ethyl 4 g/ha as PoE at 20-25 DAS | 44.9 | 16.7 | 31.1 | 29.5 | 15.1 | 91.6 | 5.7 | 3.0 | 6.4 |
| Pendimethalin 0.75 kg/ha as PE *fb* orthosulfamuron 100 g/ha as PoE | 49.4 | 19.1 | 35.4 | 35.5 | 18.3 | 97.8 | 4.4 | 1.9 | 4.4 |
| Pendimethalin 0.75 kg/ha as PE *fb* ethoxysulfuron 20 g/ha PoE | 45.9 | 16.9 | 32.3 | 31.6 | 15.3 | 93.5 | 4.9 | 2.3 | 5.8 |
| Pendimethalin 0.75 kg/ha as PE *fb* metsulfuron-methyl + chlorimuron-ethyl 4 g/ha as PoE | 52.3 | 20.2 | 38.2 | 39.7 | 20.4 | 114.3 | 2.9 | 1.4 | 2.5 |
| Hand weeding twice at 20 and 40 DAS (weed free check) | 52.3 | 20.1 | 38.1 | 39.7 | 20.7 | 114.2 | 2.7 | 1.3 | 2.3 |
| Weedy check | 30.9 | 10.9 | 10.1 | 16.6 | 9.8 | 73.4 | 31.2 | 12.2 | 27.7 |
| LSD (p=0.05) | 6.2 | 2.4 | 3.9 | 7.2 | 4.6 | 17.8 | 2.3 | 1.2 | 3.0 |

while it was minimum with pre-emergence application of pendimethalin 0.75 kg/ha *fb* PoE application of metsulfuron-methyl + chlorimuron-ethyl 4 g/ha, PE application of pendimethalin 0.75 kg/ha *fb* PoE application of ethoxysulfuron 20 g/ha, PE application of pendimethalin 0.75 kg/ha *fb* PoE application of orthosulfamuron 100 g/ha and PE application of orthosulfamuron 100 g/ha, all being on par with each other and also comparable with weed free check. Similar trend was observed for the uptake of phosphorus and potassium by weeds.

N, P and K uptake by weeds in hand weeding twice was comparable with that recorded in PE application of pendimethalin 0.75 kg/ha at 3-5 DAS *fb* PoE application of metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 20-25 DAS, PE application of pendimethalin 0.75 kg/ha at 3-5 DAS *fb* PoE application of ethoxysulfuron 20 g/ha at 20-25 DAS, pre-emergence application of pendimethalin 0.75 kg/ha at 3-5 DAS *fb* PoE application of orthosulfamuron 100 g/ha at 20-25 DAS and pre-emergence application of orthosulfamuron 100 g/ha at 3-5 DAS weeds biomass recorded in these treatments was significantly lower compared to rest of the weed control treatments as well as weedy check. Reduced uptake of nutrients (N, P and K) by weeds due to increased weed control efficiency of herbicides was documented earlier (Narolia *et al.* 2014)

## SUMMARY

Among the herbicides, application of orthosulfamuron 100 g/ha was effective in suppressing sedges and broad-leaved weeds, metsulfuron-methyl + chlorimuron-ethyl 4 g/ha was effective in suppressing broad-leaved weeds and sequential application of pendimethalin 0.75 kg/ha at 3-5 DAS *fb* metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 20-25 DAS performed better in controlling weeds resulting in higher weed control efficiency and lower weed index when compared to alone application of herbicides either as pre-emergence and post-emergence. Pre-emergence application of pendimethalin 0.75 kg/ha at 3-5 DAS *fb* metsulfuron-methyl + chlorimuron-ethyl 4 g/ha as post-emergence at 20-25 DAS, was evidenced higher grain yield and higher uptake of nutrients in crops and lower uptake of nutrients *i.e.*, N, P and K in weeds.

## REFERENCES

Jackson KL. 1973. *Soil Chemical Analysis*, Prentice hall Indian Private Limited, New Delhi.

Narolia, RS, Pratap Singh, Chandra Prakash and Harpool Meena. 2014. Effect of irrigation schedule and weed management practices on productivity and profitability of direct-seeded rice (*Oryza sativa*) in South-eastern Rajasthan. *Indian Journal of Agronomy* **59**(3): 398-403.

Rao AN and Nagamani A. 2013. Eco-efficient weed management approaches for rice in tropical Asia. pp. 78-87. In: *Proceedings of the 4th Tropical Weed Science Conference Weed Management and Utilization in the Tropics* held during January 23-25, 2013, Chiang Mai, Thailand.

Rao AN, Johnson DE, Sivaprasad B, Ladha JK, Mortimer AM. (2007). Weed management in direct-seeded rice. *Advances in Agronomy* **93**: 153-255

Sandyarani K, Malla Reddy M, Uma Reddy R and Rao PV. 2013. Influence of nitrogen and weed management on growth and yield of aerobic rice (*Oryza sativa* L.). *Journal of Research ANGRAU* **41**(1): 61-65.

Zahoor AG, Samar Singh and Samunder Singh. 2014. Integrated weed management in dry-seeded rice. *Indian Journal of Weed Science* **46**(2): 172-173.