International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; SP6: 316-318

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(Special Issue -6)
3rd National Conference
On
PROMOTING & REINVIGORATING AGRI-HORTI, TECHNOLOGICAL INNOVATIONS [PRAGATI-2019]
(14-15 December, 2019)

Influence of weed management practices on dry matter accumulation and crop growth rate of transplanted rice (*Oryza sativa*)

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Abstract
An OFT (on farm trial) entitled "Influence of weed management practices on dry matter accumulation and crop growth rate of transplanted rice (*Oryza stiva*)" was conducted on KVK, Vaishali, Dr.RPCAU, Pusa, Samstipur in two consecutive *kharif* seasons of years 2015 and 2016 on selected five farmers' field with 6 treatments. The soil was sandy loam to loam, young alluvial calcarious in nature with mean pH 8.16, mean EC 0.11, low in available N (mean value 177.01 kg/ha), medium in P (mean value 13.80 kg/ha) & K (mean value 137.28kg/ha) and low in organic carbon (mean value 0.47%). The experiment was conducted in Randomized Block Design (RBD). Mean data of two years experimentation indicated that the application of various weed management practices significantly increased dry matter accumulation on 30 DAT, 60 DAT, 90 DAT and at maturity as well as its crop growth rate of rice at different stages. Among all treatments, application of bispyribac- sodium @ 25 g ai/ha resulted in higher dry matter accumulation on 30 DAT (237.85 g/m ^{2}), 60 DAT (494.35 g/m 2), 90 DAT (897.25 g/m ^{2}) and at maturity (1076.95 g/m ^{2}) which was superior to rest of the treatments. The highest crop growth rate during 30-60 DAT, 60-90 DAT and 90 DAT–Maturity was recorded with bispyribac- sodium and minimum with weedy check. Two year study indicates that the application of bispyribac- sodium 25 g ai/ha was the best for higher crop growth rate and yield from rice.

Keywords: crop growth rate, herbicides, dry matter accumulation, yield

Introduction
Rice is the staple food for more than 65% of the people and it provides employment and livelihood security to 70% of Indian population. India grows rice in highly diverse conditions starting from below sea levels to hill as high as > 2000 metres. Major share of rice is cultivated during *kharif* season. A small share of rice is grown in *rabi*/summer season with assured irrigation. It is cultivated in an area of 43.9 million ha, with a production of 106.5 million tonnes and an average productivity of 2.4 t/ ha during 2013 – 14 (Economic Survey 2014 – 15). In Bihar, it is the most widely cultivated cereal crop during rainy season. Weeds are a major problem to rice production due to their ability to compete for resources (water, nutrient, space and light energy) and their impact on quantity and quality of the product. Weeds are responsible for heavy dry matter accumulation losses as a result yield reduction occurs. Uncontrolled weeds cause up to 80% reduction in grain yield and sometimes result in complete failure of crop (Pandey *et al.*, 2000 ; Gopinath and Kundu, 2008) [5, 3]. Proper weed management technology can help in dry matter accumulation through proper growth rate of rice plant. Thus weed management would continue to play a key role to meet the growing food demands of increasing population in India.

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Manual weeding with 'Khurpi' is a common practice in Vaishali district of Bihar. Therefore, the major challenge for farmers is effective weed management, as failure to eliminate weeds may result in low or no yield. Manual removal of weeds is labour intensive, tedious and does not ensure weed removal at critical stage of crop – weed competition due to non availability of labour, and sometimes bad weather condition which does not allow labours to move in the field. Herbicides are more effective in controlling the weeds besides reducing the total energy requirement for rice cultivation. Hence, present investigation was conducted at selected farmer's field to evaluate the effect of different weed management practices over traditional farmers' practice.

Materials and Methods

Five farmers were randomly selected for on farm trial on transplanted rice in Vaishali district of Bihar during the *kharif* season of 2015 and 2016. Soil samples were collected from selected farmer's field and were analyzed separately. The soil was sandy loam to loam, young alluvial calcarious in nature with mean pH 8.16, mean EC 0.11, low in available N (mean value 177.01 kg/ha), medium in P (mean value 13.80 kg/ha) & K (mean value 137.28kg/ha) and low in organic carbon (mean value 0.47%). The experiment comprised 6 treatments viz. weedy check, farmers' practice (one hand weeding at 25 DAT), two hand weeding (at 20 and 40 DAT), Butachlor @ 1.5 kg ai/ha (at 3 DAT), Pretilachlor @ 750 g ai/ha (at 3 DAT) and Bispyribac -Sodium @ 25 g ai/ha (at 15 DAT), were laid out in randomized block design at each farmer's field. Rice (var. - Sahbhagidhan) was sown by using seed rate of 30 kg/ha on 20 June and 25 June in 2015 and 2016 respectively. Twenty five days old seedlings of rice was transplanted using 2 seedlings per hill at 20 cm x 10 cm spacing. All the herbicides were applied with manually operated knap – sack sprayer fitted with a flat – fan nozzle using a spray volume of 500 L water/ha by keeping a thin film of water in the field. The crop was fertilized with recommended doses of fertilizers viz. 80 :40 :20 kg N, P_2O_5, K_2O /ha. Half dose of N and full P_2O_5 and K_2O were applied as basal before seedling transplanting and balance N were top – dressed in 2 equal splits – one fourth at active tillering (30-35 DAT) and the remaining one – fourth at panicle – initiation (60 -65 DAT) stage of the crop. During course of investigation, rice plants from 0.25 m row length were cut from the ground surface at 30, 60, 90 DAT and at maturity stage. These plants were sun dried for 2-3 days and were kept in oven at 65 ± 5^0C for 48 hours till a constant weight was achieved. After complete oven drying the dry weight was recorded and converted into g/m^2. Crop growth rate represents dry matter accumulation per unit area per unit time. It was calculated between 30-40, 60-90 DAT and 90 DAT to maturity stage. All the data were subjected to analysis of variance (ANOVA) as per the standard procedures and comparison of treatment means was made by critical difference (CD) at 5% probability.

Results and Discussion

Effect on dry matter accumulation

Dry matter accumulation of rice as influenced by weed management practices at 30,60, 90,days after transplanting and at maturity stage are presented in table 1.It increased with crop age the result show that all the treatments enhanced the dry matter accumulation periodically (30, 60, 90 DAT and at maturity) as compared to weedy check. At 30 DAT application of bispyribac sodium followed by pretilachlor being similar in plant dry matter accumulation had significant edge over butachlor, two hand weeding, farmers practice and weedy check. Likewise at 60 DAT weed management of rice through bispyribac sodium, pretilachlor and two hand weeding remained at par in dry matter accumulation. Further in case of weedy check accumulated minimum plant dry matter. Similarly at 90 DAT and maturity bispyribac sodium was at par with pretilachlor and two hand weeding in dry matter accumulation. The plants under these three treatments was might be due to the fact that plant faced least crop weed competition thus plants get maximum availability of nutrients sunlight and moisture which helped the plants to accumulate dry matter in greater quantity. This is in agreement with findings of Sunil *et al* (2010) [6].

Effect on crop growth rate

Crop growth rate of rice increased with the crop age up to 60-90 DAT and thereafter declined (Table 2). Weed management practice in rice had a significant effect on the crop growth rate at different stages. During 30-60 DAT application of bispyribac sodium @ 25g ai/ha recorded highest crop growth rate 8.55g/m^2 / day which was at par with pretilachlor @ 750g ai/ha (8.24 g/m^2 /day) and significantly superior over butachlor, two hand weeding, farmers practice and weedy check. During 60-90 DAT bispyribac sodium was significantly superior over pretilachlor, two hand weeding, farmers practice and weedy check but at par with application of butachlor.

During 90 DAT – maturity, bispyribac sodium @ 25g ai/ha registered maximum crop growth rate i.e 5.99 g/m^2/day significantly superior over rest all treatments except pretilachlor @750g ai/ha (5.62g/m^2/day). This might be due to effective control of weed in critical periods that accelerated photosynthetic activity ultimately leading to higher yield. Similar findings were also been reported by Sunil *et al*. (2010) [6], Kiran *et al* (2010) [4]. and Akbar *et al* (2011) [1]

On the basis of above findings, it may be concluded that application of bispyribac-sodium (25 g ai/ha) at 15 DAT increased dry matter accumulation and crop growth rate as well as maximized grain yield significantly.

Table 1: Periodic dry matter accumulation (g/m^2) of rice as influenced by different weed management practices (mean data of two years)

Treatments	30 DAT	60 DAT	90 DAT	Maturity
Weedy check	98.60	249.20	549.8	674.60
Farmers practice	169.36	389.26	739.96	891.46
Two hand weeding(20&40 DAT)	186.34	426.34	801.34	965.14
Butachlor(1.5kg/ha at 3 DAT)	158.46	392.16	772.86	941.46
Pretilachlor (750g/ha at 3 DAT)	200.85	448.05	826.35	986.55
Bispyribac- sodium (25g/ha at 15 DAT)	237.85	494.35	897.25	1076.95
SEm±	13.08	22.83	28.15	35.87
CD(P=0.05)	39.00	68.04	83.91	112.64

Table 2: Crop growth rate (g/m^2 /day) of Rice as influenced by different weed management practices (mean data of two years)

Treatments	30 -60 DAT	60 – 90 DAT	90 DAT - Maturity	Yield (q/ha)
Weedy check	5.02	10.02	4.16	22.20
Farmers practice	7.33	11.69	5.05	30.60
Two hand weeding (20&40 DAT)	8.00	12.50	5.46	37.25
Butachlor (1.5kg/ha at 3 DAT)	7.79	12.69	5.34	35.00
Pretilachlor (750g/ha at 3 DAT)	8.24	12.61	5.62	38.40
Bispyribac- sodium (25g/ha at 15 DAT)	8.55	13.43	5.99	40.50
SEm±	0.11	0.25	0.13	1.29
CD(P=0.05)	0.34	0.75	0.38	3.75

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