Weed dynamics and yield of direct seeded upland autumn rice (*Oryza sativa* L.) varieties as influenced by integrated weed and nutrient management practices

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**ABSTRACT**

A field experiment was conducted during autumn, 2014 at ICR Farm, Assam Agricultural University, Jorhat, Assam to compare three different direct seeded upland rice varieties along with different integrated weed and nutrient management practices. The experiment was carried out in factorial randomized block design replicated thrice with 15 treatments involving 3 varieties: Inglongkiri, Maizubiron and Rasi along with 5 treatments of weed and nutrient management, i.e. 20-10-10 kg/ha N-P-O-K,O + pretilachlor @ 750 g/ha followed by grubber 30 DAS (W1), 30-15-15 kg/ha N-P-O-K,O + pretilachlor @ 750 g/ha followed by grubber 30 DAS (W2), 10-5-5 kg/ha N-P-O-K,O + pretilachlor @ 750 g/ha followed by grubber 30 DAS + Vermicompost @ 1 t/ha (split equally at sowing & 30 DAS) + Sesbania (Sesbania aculeata) green mulch (up to 30 days) (W3), 10-5-5 kg/ha N-P-O-K,O + pretilachlor @ 750 g/ha followed by grubber 30 DAS with intra-row spacing 15cm (W4), and 20-10-10 kg/ha N-P-O-K,O + Weedy check (W5). The predominant weed florals observed in the experimental field were *Ageratum conyzoides*, *Cynodon dactylon*, *Cyperus rotundus* and *Cyperus iria*. Treatment W3 resulted significantly lowest weed population at all growth stages. Weed dry weight was significantly lowest with application of 30-15-15 kg/ha N-P-O-K,O along with pretilachlor @ 750 g a.i./ha and grubber 30 DAS at 20, 60 DAS and at harvest of rice crop. The results revealed an increase in yields as evident by higher grain and straw yield for all the three varieties with pre-emergence application of pretilachlor (750g a.i./ha) + grubber 30 days after sowing + 30-15-15 kg/ha of N-P-O-K,O.

**Key words:** Direct seeded rice, Integrated weed and nutrient management, Variety, Weed dynamics, Yield.

**INTRODUCTION**

Rice (*Oryza sativa* L.) is one of the most important food crops in the world, and staple food for more than 50% of the global population. Being the major source of food after wheat, it meets 43 % of calorie requirement of more than two third of the Indian population. In South Asia, rice was cultivated on 60 million hectares (m ha), and production was slightly above 225 million tonnes (m t) of paddy, accounting for 37.5 and 32% of global area and production in 2013, respectively (Mohanty, 2014). In India, it is grown on an area of about 43.5 m ha with a total production of 105.5 m t and productivity of 2.4 t/ha during 2014-15(Anonymous, 2016). Its cultivation is mainly practiced through transplanting which is cumbersome and labour intensive.

Direct seeded rice refers to the process of establishing a rice crop from seeds sown in the field rather than by transplanting seedlings from the nursery. It has been recognized as the principal method of rice establishment since 1950’s in developing countries (Pandey and Velasco, 2005). Improved short duration and high yielding varieties, nutrient and weed management techniques encouraged the farmers to shift from traditional system of transplanting to direct seeded rice culture. Direct seeding offers certain advantages like saving irrigation water, labour, energy, time, reduces emission of greenhouse-gases, better growth of succeeding crops, etc.

In general, the yield losses due to weeds in upland rice crop ranged between 66 to 92.8 percent (Maliwal and Mundra, 2011); they are a major hurdle to broad adoption of direct seeded upland rice. The key to success in direct seeded autumn rice is the availability of efficient weed control techniques (Pandey and Velasco, 2002). Thus, weeds are the most severe constraint to aerobic rice production and timely weed management is crucial to increasing the productivity of aerobic rice. Most upland and aerobic rice growers in Asia mechanically weed their crops two or three times per season, investing up to 190 person days ha⁻¹ in hand weeding (Roder, 2001). Herbicides are considered to be an alternative/ supplement to hand weeding. Both pre-emergence and post-emergence herbicides can be used in aerobic rice fields and they are effective, if properly used (Singh et al., 2006). Proper weed management practices along with integrated nutrient management (Sarkar and Gangwar, 2001), more particularly with major nutrients, significantly influence the crop productivity in upland situations.

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MATERIALS AND METHODS

A field experiment was conducted at ICR farm of Assam Agricultural University, Jorhat, Assam during autumn season of 2014 in an area of 780 sq.m.. The soil of experimental plot was sandy loam in texture with pH 4.95, organic carbon of 0.53% and 263.87, 22.10 and 134.71 kg/ha N, P and K, respectively. The experiment was carried out in factorial randomized block design replicated thrice with 15 treatments involving 3 varieties: Inglongkiri, Maizubiron and Rasi along with 5 treatments of weed and nutrient management, i.e. 20-10-10 kg/ha N-P-O-K, pretilachlor @ 750 g/ha followed by grubber 30 DAS (W1), 30-15-15 kg/ha N-P-O-K, pretilachlor @ 750 g/ha followed by grubber 30 DAS (W2), 10-5-5 kg/ha N-P-O-K, pretilachlor @ 750 g/ha followed by grubber 30 DAS + Vermicompost @ 1 t/ha (at sowing and 30 DAS) + Seshania (Sesbania aculeata) green mulch (up to 30 days) (W3), 10-5-5 kg/ha N-P-O-K, pretilachlor @ 750 g/ha followed by grubber 30 DAS with intra-row spacing 15cm (W4), and 20-10-10 kg/ha N-P-O-K + Weedy check (W5).

The nutrients N, P, K were applied in the form of urea, single super phosphate (SSP) and muriate of potash (MOP), respectively. The required amounts of P2O5 fertilizers, as per treatment, were applied as basal in the lines one day prior to sowing and thoroughly mixed with the soil. The required amounts of N and K2O fertilizers, as per treatment, were applied in two splits. Half of nitrogenous and potassic fertilizers was applied 20 days after sowing. The second top dressing with the remaining quantities of nitrogenous and potassic fertilizers was done in 40 days after sowing. The vermicompost @ 1 t/ha was applied in rows in two equal splits i.e. at basal and 30 DAS. Sesbania aculeata as green mulch was grown and incorporated in soil at 30 days DAS. The pre-emergence application of pretilachlor (Craze 50 EC) was made by spraying the herbicide spray solution on the soil surface uniformly, one day after sowing of rice seed. The spray solution, on the basis of spray volume of 500 litre ha⁻¹, was sprayed as per the treatments by using knapsack sprayer. While applying the pre-emergence herbicide, care was taken to ensure that the herbicide drift dose not reaches to adjacent experimental plots. Mechanical weeding, as per treatment, was done on 30 DAS by using manually operated grubber.

RESULTS AND DISCUSSION

Weed flora: During the experimentation, different weed flora observed were comprised of sedges, broad leave and grasses. All together 13 species were observed, out of which composition of sedges, broad leave and grasses were 25.38 per cent, 47.40 per cent and 27.22 per cent, respectively. The weed flora encompasses Ageratum conyzoides L., Cynodon dactylon (L.) Pers., Cyperus rotundus L., Cyperus iria L., Alternanthera philoxeroides (Mart.) Griseb., Borreria articaria (L. f.) F. N. Will., Phyllanthus niruri L.,

| Treatments | Days after Sowing | Echinochloa crus-galli | Cyperus plicatilis | Cyperus rotundus | Cyperus iria | Alternanthera philoxeroides | Borreria articaria | Phyllanthus niruri | Total |
|------------|-------------------|-----------------------|-------------------|-----------------|-------------|---------------------------|-------------------|-----------------|-------|
| Weedy Check | 30 DAS            | 20                    | 31                | 134             | 91          | 16                        | 42                | 53              | 200   |
| 20-10-10   |                   | 0.53                  | 0.74              | 0.04            | 0.13        | 0.02                       | 0.2              | 0.27            | 0.45  |
| N-P-O      |                   | 0.53                  | 0.74              | 0.04            | 0.13        | 0.02                       | 0.2              | 0.27            | 0.45  |
| Pretilachlor |                 |                       |                   |                 |             |                           |                   |                 |       |
| Pretilachlor |                 |                       |                   |                 |             |                           |                   |                 |       |

*Square root transformed "[(X +0.5)]" value, where X = observed value. The original value is presented in parentheses.
Among the sedges, *Cyperus rotundus* L. and *Cyperus iria* L. were dominant, while among the grasses *Cynodon dactylon* (L.) Pers. was dominant and among the broad leaved, *Ageratum conyzoides* L. was dominant species. Dominance of these weed species in upland direct seeded rice were also reported by Katki (2003) and Acharya et al. (2007). It may be due to favorable climate like, high rainfall and high temperature in the different crop growth stages and also presence of vegetative propagules in soil in regards to *Cynodon dactylon* L., and *Cyperus rotundas* L., that may help in early establishment of the weed species.

**Weed population (number m⁻²) and dry weight (g m⁻²):** Varieties could not bring about significant difference in weed density (Table 2) and dry weight (Table 3). except weed population at 40 DAS ; in regards to weed population at 40 DAS, variety Rasi resulted significantly lowest weed density (22.55) followed by that in *Inglongkiri* and *Maizubiron*. Improved variety had no significant effect on weed infestation but seemed to be essential for the yield improvement of upland rice (Gibson and Fischer, 2004).

Smith (1983) also reported the possibility of existence of allelopathic traits in wild and traditional types of rice that is at 20, 40, 60 DAS and at harvest. This might be due to overall effect of integrated method of weed management practices. Similar findings were also reported by Das and Dutta, (1995) and Singh et al., (2007). Regarding weed dry weight, weed and nutrient management through application of 30-15-15 kg ha⁻¹*N-P-O₃-K₀* along with pretilachlor @ 750 g a. i. ha⁻¹ and grubber 30 DAS significantly reduced weed dry weight at 20, 60 DAS and harvest.

The highest weed dry weight, at all the growth stages, was recorded in weedy check along with application of 20-10-10 kg ha⁻¹*N-P-O₃-K₀* as because the dry matter accumulation of weeds increased in the entire growth period due to its higher feeding ability. Moody (1990) reported that during early part of the growing season, weeds accomplished 20-30% of their growth while rice had only 2-3%.

However, at 40 DAS, application of 10-5-5 kg ha⁻¹*N-P-O₃-K₀* with vermi compost @ 1 t ha⁻¹, sesbania green mulch, pretilachlor @ 750 g a. i. ha⁻¹ and grubber 30 DAS resulted significantly lowest dry weight followed by that in 30-15-15 kg ha⁻¹*N-P-O₃-K₀* along with pretilachlor @ 750g a. i. ha⁻¹ and grubber 30 DAS. This might be due to effect of incorporation of sesbania mulching in soil at 30 DAS as well as significantly lowest density of weeds.

**Emergence pattern of weeds:** Most of the agricultural soil contains a large reservoir of weed seeds which germinate over time. The number along with type of seeds in the soil

**Table 2:** Effect of variety, weed and nutrient management practices on weed population at different periods (DAS) and harvest of *ahu* rice

| Variety          | Weed population (number m⁻²) | Weed dry weight (g m⁻²) | Treatment                                                                 |
|------------------|------------------------------|-------------------------|---------------------------------------------------------------------------|
|                  | 20 DAS | 40 DAS | 60 DAS | At harvest              | 20 DAS | 40 DAS | 60 DAS | At harvest              | 20 DAS | 40 DAS | 60 DAS | At harvest              |
| *V.*; *Inglongkiri* | 5.70(32.50) | 4.73(24.32) | 6.23(39.97) | 6.90(48.94)              | 5.36(28.34) | 4.04(15.82) | 5.69(31.95) | 6.30(39.36)              |
| *V.*; *Maizubiron*    | 5.78(33.44) | 4.81(25.19) | 6.43(42.34) | 6.93(49.35)              | 5.52(30.11) | 3.93(15.04) | 5.70(32.07) | 6.24(38.43)              |
| *V.*; *Rasi*        | 5.70(32.63) | 4.58(22.55) | 6.30(40.86) | 7.04(50.69)              | 5.33(28.10) | 3.81(14.03) | 5.56(30.47) | 6.23(38.40)              |
| S.Em +            | 0.11   | 0.05   | 0.07   | 1.04                    | CD (P = 0.05) | 0.14   | 0.18   | 0.25   | 3.90                    |

*Square root transformed [\(\sqrt{X + 0.5}\)] value, where X = observed value. The original value is presented*
Table 3: Effect of variety, weed and nutrient management practices on weed dry weight at different periods (DAS) and harvest of ahu rice

| Treatment | Variety | Weed dry weight (g m\(^{-2}\)) | 20 DAS | 40 DAS | 60 DAS | At harvest |
|-----------|---------|--------------------------------|--------|--------|--------|------------|
|           | V\(_1\): Inglongkirri | 3.26(10.25) | 4.13(18.82) | 6.25(43.97) | 8.92(82.23) |
|           | V\(_2\): Maizubiron    | 3.28(10.42) | 4.22(20.46) | 6.32(44.67) | 8.92(82.67) |
|           | V\(_3\): Rasi          | 3.32(10.72) | 3.96(17.55) | 6.15(42.40) | 8.84(80.67) |
|           | S.Em +                  | 0.04 | 0.08 | 0.10 | 0.11 |
|            | CD (P = 0.05)           | NS | NS | NS | NS |
| Weed and nutrient management | W\(_1\): 20-10-10 kg ha\(^{-1}\) N-P\(_2\)O\(_5\)-K\(_2\)O + pretilachlor @ 750g a.i. ha\(^{-1}\) + grubber 30 DAS | 3.11(9.17) | 3.29(10.51) | 4.96(24.24) | 8.05(64.38) |
|           | W\(_2\): 30-15-15 kg ha\(^{-1}\) N-P\(_2\)O\(_5\)-K\(_2\)O + pretilachlor @ 750g a.i. ha\(^{-1}\) + grubber 30 DAS | 3.03(8.75) | 3.24(10.02) | 4.76(22.32) | 7.84(61.11) |
|           | W\(_3\): 10-5-5 kg ha\(^{-1}\) N-P\(_2\)O\(_5\)-K\(_2\)O + vermicompost @ 1t ha\(^{-1}\) + sesbania green mulch + pretilachlor @ 750g a.i. ha\(^{-1}\) + grubber 30 DAS | 3.12(9.25) | 3.16(9.53) | 5.15(26.11) | 8.08(64.78) |
|           | W\(_4\): 10-5-5 kg ha\(^{-1}\) N-P\(_2\)O\(_5\)-K\(_2\)O + intra-row spacing 15 cm + pretilachlor @ 750g a.i. ha\(^{-1}\) + grubber 30 DAS | 3.18(9.62) | 3.60(12.56) | 5.58(30.69) | 8.08(64.89) |
|           | W\(_5\): 20-10-10 kg ha\(^{-1}\) N-P\(_2\)O\(_5\)-K\(_2\)O + weedy check | 4.00(15.54) | 7.23(52.09) | 10.75(115.03) | 12.42(154.11) |
|           | S.Em +                  | 0.05 | 0.10 | 0.13 | 0.14 |
|            | CD (P = 0.05)           | 0.15 | 0.30 | 0.38 | 0.41 |

*Square root transformed [\(\sqrt{(X +0.5)}\)] value, where X = observed value. The original value is presented in parentheses.

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are influenced by numerous factors like, field’s cropping history, edaphic characteristics such as moisture holding capacity, soil pH, past weed control practices, tillage practices and perhaps of greatest importance is weed seed dormancy along with seed viability. Rate of emergence is also determined by these factors as well as by climate, particularly rainfall and temperature, rate of germination and seedling growth of each species.

Experimental data revealed that, broad leave weeds were the dominant types throughout the growth season except at 40 DAS wherein sedges were predominant. At early stage *i.e.* 20 DAS, broad leaved constitute higher percentage (41 per cent), followed by grasses (32 per cent) and sedges (27 per cent). Similarly, at 40 DAS, sedges constitute 38.76 per cent of density, broad leaved weeds constitute 33.01 per cent, and grasses 28.23 percent. At 60 DAS, the share of broad leaved weeds is 48 per cent followed by sedges (27.60 per...
Table 4: Effect of variety, weed and nutrient management practices on weed control index at different periods (DAS) and harvest of *ahu* rice

| Treatment | Weed control index (%) | 20 DAS | 40 DAS | 60 DAS | At harvest |
|-----------|------------------------|--------|--------|--------|------------|
| Variety   |                        |        |        |        |            |
| V₁: Inglongkiri |                     | 31.91  | 61.35  | 60.26  | 45.49      |
| V₂: Maizubiron  |                      | 30.79  | 65.24  | 57.74  | 48.29      |
| V₃: Rasi      |                       | 34.74  | 63.37  | 61.39  | 46.65      |
| Weed and nutrient management |                |        |        |        |            |
| W₁: 20-10-10 kg ha⁻¹ N-P₂O₅-K₂O + pretilachlor @ 750 g a.i. ha⁻¹ + grubber 30 DAS | 40.79 | 79.65 | 75.61  | 58.06      |
| W₂: 30-15-15 kg ha⁻¹ N-P₂O₅-K₂O + pretilachlor @ 750 g a.i. ha⁻¹ + grubber 30 DAS | 43.41 | 80.44 | 77.70  | 60.04      |
| W₃: 10-5-5 kg ha⁻¹ N-P₂O₅-K₂O + vermicompost @ 1t ha⁻¹ + sesbania green mulch + pretilachlor @ 750 g a.i. ha⁻¹ + grubber 30 DAS | 40.17 | 81.36 | 76.08  | 58.45      |
| W₄: 10-5-5 kg ha⁻¹ N-P₂O₅-K₂O + intra-row spacing 15 cm + pretilachlor @ 750 g a.i. ha⁻¹ + grubber 30 DAS | 38.04 | 75.15 | 66.61  | 57.49      |
| W₅: 20-10-10 kg ha⁻¹ N-P₂O₅-K₂O + weedy check | -    | -     | -      | -       |

Table 5: Effect of variety, weed and nutrient management practices on weed control efficiency at different periods (DAS) and harvest of *ahu* rice

| Treatment | Weed control efficiency (%) | 20 DAS | 40 DAS | 60 DAS | At harvest |
|-----------|----------------------------|--------|--------|--------|------------|
| Variety   |                           |        |        |        |            |
| V₁: Inglongkiri |                       | 30.74  | 60.31  | 46.73  | 45.70      |
| V₂: Maizubiron  |                        | 32.79  | 60.16  | 45.90  | 45.88      |
| V₃: Rasi      |                         | 33.24  | 58.43  | 47.35  | 44.15      |
| Weed and nutrient management |                 |        |        |        |            |
| W₁: 20-10-10 kg ha⁻¹ N-P₂O₅-K₂O + pretilachlor @ 750 g a.i. ha⁻¹ + grubber 30 DAS | 41.50 | 73.28 | 58.36  | 56.60      |
| W₂: 30-15-15 kg ha⁻¹ N-P₂O₅-K₂O + pretilachlor @ 750 g a.i. ha⁻¹ + grubber 30 DAS | 37.90 | 74.81 | 58.24  | 57.58      |
| W₃: 10-5-5 kg ha⁻¹ N-P₂O₅-K₂O + vermicompost @ 1t ha⁻¹ + sesbania green mulch + pretilachlor @ 750 g a.i. ha⁻¹ + grubber 30 DAS | 42.15 | 76.38 | 60.39  | 57.63      |
| W₄: 10-5-5 kg ha⁻¹ N-P₂O₅-K₂O + intra-row spacing 15 cm + pretilachlor @ 750 g a.i. ha⁻¹ + grubber 30 DAS | 39.72 | 73.71 | 56.32  | 54.40      |
| W₅: 20-10-10 kg ha⁻¹ N-P₂O₅-K₂O + weedy check | -    | -     | -      | -       |
Weed control efficiency (%) and weed control index (%): The weed control efficiency and weed control index are the two indicators to evaluate the performance of various weed control practices. Adoption of different varieties along with weed and nutrient management practices resulted in variation in these two indices.

Highest weed control efficiency was found in variety Rasi (V₃) in all growth stages except 40 DAS. Among the weed and nutrient management practices, application of 10-5-5 kg ha⁻¹ N-P₂O₅-K₂O along with vermicompost @ 1 t ha⁻¹, sesbania green mulch, pretilachlor @ 750 g a.i. ha⁻¹ and grubber 30 DAS (W₃) showed highest weed control efficiency at all four growth stages (Table 4). This is due to lower weed density in respective varieties as well as weed and nutrient management practices (Mann et al., 2007).

Rasi also showed highest weed control index at 20 and 60 DAS while, Maizubiron showed highest weed control index at 40 DAS and at harvest. Application of 30-15-15 kg ha⁻¹ N-P₂O₅-K₂O along with pretilachlor @ 750 g a.i. ha⁻¹ and grubber 30 DAS showed highest weed control index at all growth stages except 40 DAS (Table 5). This is due to lower weed dry weight in respective varieties as well as weed and nutrient management practices (Mahajan et al., 2009).

Grain yield and straw yield (q ha⁻¹): A perusal of the findings revealed that there was no significant difference in grain yield amongst the three varieties tested while Inglonkiri

| Treatment | Grain yield (q ha⁻¹) | Straw yield (q ha⁻¹) |
|-----------|----------------------|---------------------|
| V₃: Inglonkiri | 15.96 | 21.05 |
| V₄: Maizubiron | 15.50 | 21.03 |
| V₅: Rasi | 16.05 | 20.17 |
| S.Em ± CD (P = 0.05) | 0.20 | 0.11 |
| CD (P = 0.05) | NS | 0.31 |

Table 6.6: Interaction effect of variety with weed and nutrient management practices on straw yield (q ha⁻¹) of ahu rice.

| Variety | Weed and nutrient management |
|---------|-----------------------------|
| W₁ | V₃ | W₂ | W₃ | W₄ | W₅ |
| V₃ | 19.00 | 20.68 | 16.76 | 15.73 | 7.65 |
| V₄ | 17.82 | 20.05 | 16.19 | 15.53 | 7.89 |
| V₅ | 19.50 | 21.87 | 17.42 | 15.93 | 5.55 |
| S.Em ± C.D. (P=0.05) | 0.45 | 0.75 | 0.24 | 0.70 |

Table 6.7: Interaction effect of variety with weed and nutrient management practices on straw yield (q ha⁻¹) of ahu rice.

| Variety | Weed and nutrient management |
|---------|-----------------------------|
| W₁ | V₃ | W₂ | W₃ | W₄ | W₅ |
| V₃ | 25.50 | 26.24 | 22.75 | 21.26 | 9.51 |
| V₄ | 25.42 | 26.58 | 22.65 | 21.21 | 9.29 |
| V₅ | 25.07 | 26.12 | 22.28 | 20.29 | 7.10 |
| S.Em ± C.D. (P=0.05) | 0.24 | 0.70 |

showed significantly higher straw yield (Table 6). It might be due to significantly higher plant height at harvest in Inglonkiri. Regarding the factor, weed and nutrient management, application of 30-15-15 kg/ha N-P₂O₅-K₂O along with pretilachlor @ 750 g a.i./ha and use of grubber 30 DAS (W₅) showed significantly higher grain yield and straw yield. The higher grain yield might be due to better nutrition of rice crop owing to application of higher dose of major nutrients as well as reduction in crop weed competition due to combined methods of weed control i.e. chemical and mechanical, that resulted in statistically superior growth characters (LAI, number of tillers and dry matter accumulation) and yield attributing characters (number of panicles, panicle length and number of filled grains). Kavitha et al., (2010) reported that application of pretilachlor
suppressed the weed in the early growth stages of autumn rice leading to higher yield. The higher straw yield might be due to higher amount of dry matter production at 30 and 60 DAS in W5. The improved cultivars produced higher yields than traditional cultivars in both high and low fertility conditions (Saito et al., 2006).

The grain and straw yield were affected significantly by the interaction effect of varieties and weed and nutrient management practices. The results revealed that higher grain yield was given by Rasi, when combined with application of 30-15-15 kg/ha N-P2O5-K2O along with pretilachlor @ 750 g a.i./ha and use of grubber 30 DAS (W5) while Inglongkiri showed significantly higher straw yield when combined with W5.

CONCLUSION
Rice is the most important grain with regard to human nutrition and calorie intake, providing more than one-fifth of the calories consumed by human worldwide. Major share of area in rice is cultivated during kharif season, with a small share in rabi/summer season in areas of assured irrigation. Indian rice production depends on monsoon rains and only 59 per cent of rice area has assured irrigation. Experiment results revealed that application of 10-5-5 kg ha\(^{-1}\) N-P2O5-K2O along with vermicompost @ 1 t ha\(^{-1}\), Sesbania green mulch, pretilachlor @ 750 g a.i. ha\(^{-1}\) and use of grubber 30 DAS recorded significantly lowest weed density at all growth stages studied while application of 20-15-15 kg ha\(^{-1}\) of N-P2O5-K2O along with weedy check showed significantly highest weed density and weed dry weight throughout the observed crop growth stages. Rasi showed higher weed control index and weed control efficiency as compared to Inglongkiri and Maizubiron. No significant difference in grain yield amongst the three varieties tested while Inglongkiri showed significantly higher straw yield. It might be due to significantly higher plant height at harvest in Inglongkiri. Regarding the factor, weed and nutrient management, application of 30-15-15 kg/ha N-P2O5-K2O along with pretilachlor @ 750 g a.i./ha and use of grubber 30 DAS (W5) showed significantly higher grain yield and straw yield.

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