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# Weed management in hybrid cotton (*Gossypium hirsutum L.*) under upland rainfed ecosystem

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**ABSTRACT:** A field experiment was carried out at the Research Farm Regional Research and Technology Transfer Station, Bhawanipatna, Odisha University of Agriculture and Technology during kharif 2012-2013 and 2013-2014 to evaluate different weed management methods in hybrid cotton. The trial was laid out in randomized block design with 3 replications and 8 treatments. Results revealed that all herbicides either alone or in combination significantly reduced the weed population and dry matter accumulation throughout the growth stages along with improvement in weed control efficiency in comparison with weedy check. Among the treatments pre emergence application of pendimethalin with sequential application of quizalofop-p-ethyl supplemented with one hoeing recorded the highest seed cotton yield (2491 kg/ha), net monetary returns ( Rs. 79095) and benefit cost ratio (3.39) which was *at par* with the weed free treatment. The reduction in seed cotton yield was to the tune of 56.6 per cent in weedy check.

**Key words :** Hybrid cotton, pendimethalin, weed control efficiency, weed density, weed management,

Cotton crop is prone to severe weed competition because it is wide spaced and have slow initial growth. It is infested with grasses, sedges and broad leaf weeds under upland ecosystem during rainy season. The yield reduction due to weed infestation is to the tune of 60 per cent (Sadangi and Barik, 2007). It is common recommendation to apply pendimethalin as pre emergence spray supplemented with two to three intercultivations (Prabhu *et al.,* 2010). Due to incessant rainfall during vegetative stages it is very difficult to adopt intercultivation frequently at right times. Several workers tested the use of post emergence herbicides like pyrythiobac sodium (Rao, 2011), glyphosate ( Prabhu *et al.*, 2011 and Rao, 2011), and quizalofop-p-ethyl (Prabhu *et al.*, 2011 and Rao, 2011) either alone or in combination. The primary mode of action of pendimethalin is to prevent plant cell division and elongation in susceptible species. Pyrithiobac sodium inhibits Acetolactase synthase, a key enzyme in biosynthesis of branched chain amino acids. Quizalofop-p-ethyl inhibits Acetyl CoA Carboxylase, a key enzyme in biosynthesis of fatty acids. Glyphosate kills plants by inhibiting enol pyruvyl shikimate phosphate synthase a key enzyme necessary for the biosynthesis of aromatic amino acids like phenylalanine, tyrosine and tryptophane, auxins, phytoalexins, folic acids, lignin and many other secondary products. Thus an attempt has been made in this study for sequential application of pendimethalin and quizalofop-p-ethyl and also tank mixing of pyrithiobac sodium and quizalofop-p-ethyl having different modes of action in order to achieve the most effective and economic method of weed management in hybrid cotton.

## MATERIALS AND METHODS

A field experiment was carried out at the Research Farm of the Regional Research and Technology Transfer Station, Bhawanipatna, Odisha University of Agriculture and Technology during *kharif*, 2012-2013 and 2013-2014. The soil

of the experimental site was clay loam in texture, low in available N, medium in available P and K with pH of 6.11. The trial was laid out in randomized block design with three replications and eight treatments. The hybrid cotton Bunny was sown with a spacing of 90 x 60 cm. The crop was raised with all recommended package of practices other than the weed control measures which were under testing. The herbicide pendimethalin was applied as pre emergence spray at one day after sowing (DAS). Post emergence application of pyrithiobac sodium and quizalofop-p-ethyl was made at 30 DAS and glyphosate at 45 DAS. All the herbicides were followed by one hand weeding at 45 DAS except glyphosate and the weedy check. In the weed free treatment three hoeing and weedings were carried out at 20, 40 and 60 DAS. The herbicides were sprayed with knapsack sprayer fitted with flat fan nozzle using the spray volume of 500 l/ ha. Weed density was recorded at 30, 60 and 90 DAS and data was subjected to square root transformation (x+0.5) before statistical analysis to normalize the distribution (Panse and Sukhatme, 1978). Weed control efficiency was computed as prescribed by Mani *et al.,* (1973) and expressed as percentage. Weed index was also calculated using the formula suggested by Gill and Vijay Kumar (1969).

## RESULTS AND DISCUSSIONS

**Effects on weeds:**The experimental plot was infested with almost all types weeds like grasses ( *Cynodon dactylon, Echinochloa colona, Digitaria sanguinalis, Eleusine indica, Sporobolus marginatus*), sedges ( *Cyperus rotundus, Cyperus iria*) and broad leaf weeds (*Ageratum conyzoides, Cleome viscosa, Amaranthus viridis, Melochia corchorifolia, Phyllanthus niruri*).

Application of all herbicides either alone or in combination significantly reduced the weed population and dry matter accumulation throughout the growth stages in comparison with weedy check (Table 1). Among the weed management treatments, weed free condition followed by pre emergence application of pendimethalin with sequential application of quizalofop-p-ethyl supplemented with one hoeing was found superior over other treatments in eliminating weed density and dry matter. This might be due to reduction in crop weed competition from the germination stage by pendimethalin followed by control of grassy weeds at early vegetative stages of growth by quizalofop-p-ethyl and killing of all types of weeds by hoeing

**Table 1.** Effect of different treatments on density and dry weight of weeds in cotton (Pooled data of two years)

| Treatments | Dose (g/ha) | Time of application (DAS) | Weed density(Number/sqm) 30DAS | 60DAS | 90DAS | Weed dry weight (g/sqm) at 60 DAS | Weed control efficiency (%) at 60 DAS |
|---|---|---|---|---|---|---|---|
| **T1:**Pendimethalin + 1 hoeing | 1000 | 1 | 13.4(179.3) | 11.2(126.0) | 12.0(143.7) | 9.4(87.7) | 48.28 |
| **T2:** Quizalofop-p-ethyl + 1 hoeing | 50 | 30 | 18.2(331.0) | 12.3(151.0) | 13.6(184.7) | 10.9(119.2) | 29.70 |
| **T3:**Pendimethalin + Quizalofop-p-ethyl + 1 hoeing | 1000+50 | 1 and 30 | 11.5(130.7) | 9.5(90.7) | 10.2(102.7) | 9.4(89.7) | 47.10 |
| **T4:** Pyrithiobac sodium + 1 hoeing | 62.5 | 30 | 15.1(226.7) | 12.0(144.7) | 13.4(179.5) | 9.4(88.8) | 47.59 |
| **T5:** Pyrithiobac sodium+ Quizalofop-p- ethyl + 1 hoeing | 62.5+50 | 30 | 14.5(211.3) | 11.9(142.0) | 13.1(171.0) | 10.7(113.3) | 33.14 |
| **T6:** Glyphosate | 1000 | 45 | 14.2(201.7) | 11.4(129.0) | 12.4(154.0) | 10.2(103.8) | 38.74 |
| **T7:** Weed free check (Hoeing and weeding) | 3 | 20,40 and 60 | 6.6(44.0) | 5.2(27.3) | 5.6(31.0) | 4.3(17.7) | 89.58 |
| **T8:** Weedy check | - | - | 18.6(345.7) | 15.2(230.0) | 17.0(288.3) | 13.0(169.5) | 0.00 |
| SEm+ | | | 0.24 | 0.20 | 0.08 | 0.5 | |
| CD (p=0.05) | | | 0.7 | 0.57 | 0.25 | 1.4 | |

**Table 2.** Effect of different treatments on yield and yield components in cotton (Pooled data for two years)

| Treatments | Bolls/ plant | Boll weight (g) | Seed cotton yield (kg/ha) | Weed index | Net returns (Rs/ha) | BCR (Rs/R) |
|---|---|---|---|---|---|---|
| **T1:**Pendimethalin @ 1.0 kg /ha as pre-em + 1 hoeing at 45 DAS | 39.6 | 4.5 | 2305 | 7.5 | 70725 | 3.14 |
| **T2:** Quizalofop-p-ethyl @ 50 g /ha at 30 DAS + 1 hoeing at 45 DAS | 32.6 | 4.4 | 1919 | 22.9 | 53328 | 2.61 |
| **T3:**Pendimethalin @ 1.0 kg /ha + Quizalofop-p- ethyl @ 50 g /ha +1 hoeing at 45 DAS | 43.0 | 4.3 | 2491 | 0 | 79095 | 3.39 |
| **T4:** Pyrithiobac sodium @ 62.5 g /ha at 20-30 DAS + 1 hoeing at 45 DAS | 34.9 | 4.4 | 1931 | 22.5 | 53895 | 2.63 |
| **T5:** Pyrithiobac sodium @ 62.5 g /ha at 20- 30 DAS + Quizalofop-p- ethyl @ 50 g/ha + 1 hoeing at 45 DAS | 37.5 | 4.5 | 2137 | 14.2 | 63165 | 2.91 |
| **T6:** Glyphosate @ 1.0 kg/ha at 45 DAS | 38.6 | 4.5 | 2254 | 9.5 | 68430 | 3.07 |
| **T7:** Weed free check (hoeing and weeding at 20, 40 and 60DAS) | 43.5 | 4.5 | 2465 | 1.0 | 67430 | 3.26 |
| **T8:** Weedy check | 20.1 | 4.1 | 1082 | 56.6 | 18690 | 1.62 |
| SEm+ | 1.8 | 0.10 | 149.2 | - | - | - |
| CD (p=0.05) | 5.2 | 0.3 | 428.4 | - | - | - |

at branching and square formation stage. This corroborates with the findings of Prabhu *et al.,* 2011. Weed control efficiency was the highest in weed free treatment followed by pre emergence application of pendimethalin with one hoeing and application of pyrithiobac sodium with one hoeing.

**Effect on crop:** The yield components and the seed cotton yield were significantly affected by all weed management treatments over the weedy check (Table 2). Weed free treatment recorded the highest number of bolls/plant (43.5) which remained *at par* with pre emergence application of pendimethalin with sequential application of quizalofop-p-ethyl supplemented with one hoeing (43.0), pre emergence application of pendimethalin with one hoeing (39.6) and post emergence application of glyphosate (38.6). Maximum boll weight was observed in weed free treatment (4.5 g) which was *at par* with all other weed management treatments except weedy check (4.1). Pre emergence application of pendimethalin with sequential application of quizalofop-p-ethyl supplemented with one hoeing recorded the highest seed cotton yield (2491 kg/ha) closely followed by weed free treatment (2465 kg/ha) which were found *at par* with pre emergence application of pendimethalin with one hoeing, post emergence application of glyphosate and tank mix application of pyrithiobac sodium with quizalofop-p- ethyl followed by one hoeing. This was achieved owing to timely and effective control of weeds resulting in availability of better soil moisture and nutrients thereby increasing yield attributes and fibre yield. Similar findings were reported by Prabhu *et al.,* (2011) and Patel *et al.*, (2011). Data on weed index revealed that maximum reduction in seed cotton yield (56.6%) was observed in weedy check treatment as compared to that in the best treatment.

**Economics:** Considering the economics, the maximum net return (Rs 79,095) and benefit cost ratio (3.9) was registered in pre emergence application of pendimethalin with sequential application of quizalofop-p-ethyl supplemented with one hoeing followed by pre emergence application of pendimethalin with one hoeing.

Therefore, it may be concluded that pre emergence application of pendimethalin @ 1.0 kg/ha at 1 DAS with sequential application of quizalofop-p-ethyl @ 50 g/ha at 30 DAS supplemented with one hoeing at 45 DAS was the most effective and economic method of weed control in rainfed hybridcotton.

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