Economically beneficial weed control practices for
direct seeded rice under rainfed condition

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Abstract
A field experiment entitled “studies on economical weed control in direct seeded rice under rainfed condition” was conducted at agricultural college farm, Rajendranagar, Hyderabad, during kharif, 2010. The higher grain yield was obtained with T 5–[Cyhalofop-butyl+ (Chlorimuron-ethyl+ Metsulfuron-methyl) @ 90+20 g ha⁻¹] and it was found at par with T 8–(Fenoxaprop-p-ethyl + Ethoxysulfuron @ 60+15 g ha⁻¹), and also with farmers practice i.e. T 10–(Two Hand weedings at 20 and 40 DAS). N, P and K uptake by grain at harvest was significantly more in T 10–(Two Hand weedings at 20 and 40 DAS) followed by T 5–[Cyhalofop-butyl+ (Chlorimuron-ethyl+ Metsulfuron-methyl) @ 90+20 g ha⁻¹]. Both T10 and T5 were significantly superior to other weed control treatments. The highest gross (Rs.41256), net returns (Rs.24369) and BCR (2.44) were recorded by T 5–[Cyhalofop-butyl+ (Chlorimuron-ethyl+Metsulfuron-methyl) @ 90+20 g ha⁻¹].

Keywords: Economically beneficial weed, seeded rice, rainfed condition

1. Introduction
Rice (Oryza sativa L.) is the major food crop for the more than half of the global population and will continue to occupy the pivotal place in global food and livelihood security system. Hence called as “Global Grain” it is the staple cereal food grain of majority of India’s over one billion population, contributes to nearly 44% of total food grain production. The production of conventional puddle transplanted rice faces severe constraints because of water and labour scarcity and climatic changes (Pathak et al., 2011) [4]. Imminent water crisis, water demanding nature of traditionally cultivated rice and climbing labour costs, ramble the search for alternative management methods to increase water productivity, system sustainability and profitability. Direct seeded rice (DSR) technique is becoming popular nowadays because of its low input demanding nature. Weeds are major biological constraints to obtain optimum yield and productivity (Rao and Nagamani, 2013) [6] and it causes yield loses from 15 to 76 % in rice (Mishra et al., 2012).

2. Materials and Methods
Field experiment was conducted at the college farm, ANGRAU Rajendranagar, Hyderabad during kharif season of 2010-11. To find the best weed control practice in direct seeded rice. The farm is located at an altitude of 542.6 m above mean sea level with geographical bearing of 78° 21' E longitude and 17° 19' N latitude. The soil of the experimental field was sandy clay loam in texture with moderate drainage. Composite soil samples were collected prior to the experiment and analyzed for various physical and chemical characteristics. The soil was low in available nitrogen (230 kg ha⁻¹), high in available phosphorus (28 kg ha⁻¹) and medium in available potassium (86 kg ha⁻¹), contents. The pH was 7.8 of the soil. The field experiment was comprises of eleven treatments of weed management practices T 1–(Pyrzosulfuron-ethyl @ 25 g ha⁻¹), T 2–(Pretilachlor-S @ 750 g ha⁻¹), T 3–(Cyhalofop-butyl @ 90 g ha⁻¹), T 4–(Fenoxaprop-p-ethyl @ 60 g ha⁻¹), T 5–[Cyhalofop-buty1+ (chlorimuron-ethyl+mestulfuron-methyl) @ 90+20 g ha⁻¹], T 6–[Fenoxaprop-p-ethyl + (chlorimuron-ethyl+mestulfuron-methyl) @ 60+20 g ha⁻¹], T 7–(Bispyribac sodium @ 25 g ha⁻¹), T 8–(Fenoxaprop-p-ethyl + Ethoxysulfuron @ 60+15 g ha⁻¹), T 9–(Oxyfluorfen followedby 2,4-D @ 300 fb 0.5 g ha⁻¹), T 10–(Two Hand weedings at 20 and 40 DAS) and T 11 - Weedy check. The experiment was laid out in a randomized block design with three replications.

Medium duration rice variety MTU-1010 was used in the present experiment the good quality seeds were sown @ 100 kg ha⁻¹, by adopting a spacing of 15 x 10 cm. The crop was sown on 5th August 2010.
One light irrigation was given immediately after sowing for proper germination and establishment. Biometric observations were recorded both on weed and crop at different stages. For the purpose of recording data on weed and crop, one square meter area in each net plot was randomly demarcated.

### 3. Results and Discussion

The weed flora associated with experimental crop consisted of grasses *viz.* Echinochloa colona, Echinochloa crusgalli, Cynodon dactylon, Digitaria angustifolia, sedges *viz.* Cyperus rotundus, Cyperus difformis and broad leaf weeds *viz.* Phyllanthus cuspidatus, Physalis minima, Alternanthera sessilis, Commelina bengalensis, Digena argiophorus, Celosia argentina, Parthenium hysterophorus, Cleome viscosa and Eclipta alba. Among these, broad leaf weeds are dominant weeds followed by sedges and grasses in dry seeded rainfed rice.

Significantly lower weed density was recorded by T₅–[Cyhalofop-butyl + (Chlorimuron-ethyl + Metsulfuron-methyl) @ 90+20 g ha⁻¹] (15.33) at harvest recorded less weed density at harvest but the weed dry weight was very high due to the predominance of broad leaf weed species like Celosia argentina, Parthenium hysterophorus, Alternanthera sessilis, Cleome viscosa which contributed more dry weight. Similar results were reported by Ramaiah and Krishnan, (1992) in Cynadondactylon, Digitariasangunalis, grasses

#### 3.1. Results

The treatments T₃–[Cyhalofop-butyl @ 90+20 g ha⁻¹], T₆–[Fenoxaprop-p-ethyl + (Chlorimuron-ethyl + Metsulfuron-methyl) @ 60+20 g ha⁻¹], T₇–[Bispyribac sodium @ 25 g ha⁻¹] and T₈–[Oxyfluorfen fb 2,4-D @ 300 fb 500g ha⁻¹] maintained their superiority in terms of plant height, number of tillers per m² by effectively controlling weeds over other treatments. Among all chemical treatments T₅–(Fenoxaprop-p-ethyl @ 60 g ha⁻¹) (207.68) recorded the lowest number of tillers followed by T₉–(Cyhalofop-butyl @ 90 g ha⁻¹) (227.57), T₂–(Pretilachlor-S @ 750 g ha⁻¹) (238.33) and T₁–(Pyrozulfuron-ethyl @ 25 g ha⁻¹) (236.33). The efficacy of those herbicides applied as early post emergence was reflected in tiller number at later crop growth stages. Similar results were reported by Saini et al. (2001) in direct seeded semi dry rice and Riaz et al. (2007) in direct seeded rice crop.

The results indicated that the treatment T₅–[Cyhalofop-butyl + (Chlorimuron-ethyl + Metsulfuron-methyl) @ 90+20 g ha⁻¹] recorded maximum grain yield of 3820 kg ha⁻¹ and remained par at T₁₀ –(Two hand weedings at 20 and 40 DAS) (3987 kg ha⁻¹) and found significantly superior to the rest of treatments. Next to T₅–[Cyhalofop-butyl + (Chlorimuron-ethyl + Metsulfuron-methyl) @ 90+20 g ha⁻¹], T₆–(Fenoxaprop-p-ethyl + Ethoxysulfuron @ 60+15 g ha⁻¹) (3464 kg ha⁻¹) followed by T₉–[Fenoxaprop-p-ethyl + (Chlorimuron-ethyl + Metsulfuron-methyl) @ 90+20 g ha⁻¹] (3426 kg ha⁻¹).

#### 3.2. Discussion

The weed density and dry weight per plot were recorded at harvest (1244 kg ha⁻¹). The maximum grain production by T₅–[Cyhalofop-butyl + (Chlorimuron-ethyl + Metsulfuron-methyl) @ 90+20 g ha⁻¹] was due to its effectiveness in controlling weeds and improvement in the growth and development of crop and higher yield attributes of rice crop. Similar results were reported by Bali et al., (2006), Saini, (2005), Mukherjee and Singh (2005), Kathivelann and Vaiyapuri, (2004), Saini et al, Saini et al, (2001), (2006) and Choubey et al. (2001).

#### 3.3. Economics

The highest gross returns (Rs.41256), net returns (Rs.24369) and BCR (2.44) were obtained with T₅–[Cyhalofop-butyl + (Chlorimuron-ethyl + Metsulfuron-methyl) @ 90+20 g ha⁻¹] and were higher as compared to other weed control treatments. Next to T₅ T₆ – (Fenoxaprop-p-ethyl + Ethoxysulfuron @ 60+15 g ha⁻¹) gave better results. The performance of T₅ and T₆ was superior to the rest of the treatments. These two early post-emergence herbicides are suitable for controlling weeds in direct seeded rainfed rice and comparable to two hand weedings treatment. In the event of labour shortage and continuous rains, the herbicide Cyhalofop-butyl + (Chlorimuron-ethyl + Metsulfuron-methyl) could be used for effective weed control in direct seeded rainfed rice.

### 4. Conclusions

Among the weed control treatments, the chemical treatment *i.e.* Cyhalofop - butyl + (Chlorimuron –ethyl + Metsulfuron methyl) @ 90+20 g ha⁻¹ was found effective in controlling different weeds and recorded higher WCE of 82.13% in direct seeded rainfed rice. The early post-emergence herbicides were found effective as compared to pre-emergence herbicides for better growth of rice and higher grain yield. Among the early post-emergence herbicides, application of Cyhalofop-butyl + (Chlorimuron-ethyl + Metsulfuron-methyl) @ 90+20 g ha⁻¹ recorded at par grain yield with that of hand weeding treatment (at 20 and 40 DAS).

### Table 2: Effect of weed control treatments on weed index (WI), grain yield (kg ha⁻¹) and B: C ratio of dry-seeded rainfed rice

<table>
<thead>
<tr>
<th>S. no</th>
<th>Treatments</th>
<th>Time of application (DAS)</th>
<th>Dose (g ha⁻¹)</th>
<th>Weed index (WI)</th>
<th>Grain yield (kg ha⁻¹)</th>
<th>B:C Ratio</th>
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<td>T₁</td>
<td>Pyrozulfuron-ethyl</td>
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<td>50.06</td>
<td>1987.00</td>
<td>1.42</td>
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<td>60+20</td>
<td>14.07</td>
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<td>60+15</td>
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<td>Oxyfluorfen + 2,4-D</td>
<td>0-5 fb 30</td>
<td>300 fb 0.5</td>
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<td>3144.000</td>
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</table>

S.Em(+_+ - 107.32 -

C.D (p=0.05)

~ 1962 ~
Cyhalofop-butyl + (Chlorimuron-ethyl+Metsulfuron-methyl) @ 90+20 g ha\(^{-1}\) was found economically beneficial weed control practice and recorded maximum BCR (2.22) over two hand weedings treatment (2.08).

6. References