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## Weed management in yellow sarson using herbicide with and without soil mulch in direct seeded rice-yellow sarson cropping system

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### Abstract

In the *kharif* and *rabi* seasons of 2021-2022, a field experiment was carried out at the Institute of Agriculture's Agricultural Farm in Visva-Bharati, Sriniketan, Birbhum, West Bengal, to study the impact of herbicides and soil mulch sowing on weed control in yellow sarson (*Brassica campestris* L var. yellow sarson) in a direct seeded rice (DSR)-yellow sarson cropping sequence. In DSR two treatments viz. soil mulch (pre-sowing irrigation followed by sowing) and no mulch (sowing followed by irrigation) in main plot and pre-emergence (PE) oxadiargyl at 90 g ha<sup>-1</sup>; post emergence (PoE) bispyribac sodium at 25 g ha<sup>-1</sup>; PE oxadiargyl at 90 g ha<sup>-1</sup> *fb* PoE bispyribac sodium 25 g ha<sup>-1</sup>; premix triafamone 20% + ethoxysulfuron 10% at 60 g ha<sup>-1</sup> and unweeded control were assigned in subplots in a split-plot design replicated thrice. Yellow sarson cultivar "B-9" was grown as a sequential crop under zero tillage without much disturbance of the soil. Each subplot of yellow sarson was split in halves. To examine the impact of treatments used in DSR, one plot was maintained as a control, and in another plot recommended herbicide, pendimethalin at 0.75 kg ha<sup>-1</sup> was applied as PE. The six major weed species infested the crop yellow sarson among which *Cynodon dactylon*, *Digitaria sanguinalis*, *Polygonum plebeium*, *Spilanthes calva*, *Eclipta alba* and *Gnaphalium indicum* were predominant throughout the cropping period. In the plots where soil mulch sowing was carried out in preceding rice crop, the density and dry weight of all weed species were lowered. The treatment PE application of oxadiargyl at 90 g ha<sup>-1</sup> *fb* PoE application of bispyribac sodium at 25 g ha<sup>-1</sup> in DSR and PE pendimethalin at 0.75 kg ha<sup>-1</sup> in yellow sarson and PoE premix triafamone 20% + ethoxysulfuron 10% at 60 g ha<sup>-1</sup> in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> in yellow sarson recorded lower values of density and biomass of all weed species. Soil mulch sowing recorded significantly higher values of siliquae plant<sup>-1</sup> and seeds siliqua<sup>-1</sup> registering 6.84% higher seed yield over no mulch sowing. Pre-emergence application of oxadiargyl at 90 g ha<sup>-1</sup> *fb* PoE bispyribac sodium at 25 g ha<sup>-1</sup> in DSR and PE pendimethalin at 0.75 kg ha<sup>-1</sup> in yellow sarson recorded the highest seed yield of yellow sarson and was on par with PoE premix triafamone 20% + ethoxysulfuron 10% at 60 g ha<sup>-1</sup> in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> in yellow sarson. Soil mulch sowing of DSR along with sequential application of PE oxadiargyl at 90 g ha<sup>-1</sup> *fb* PoE bispyribac sodium at 25 g ha<sup>-1</sup> or PoE premix triafamone 20% + ethoxysulfuron 10% at 60 g ha<sup>-1</sup> alone in DSR *fb* PE pendimethalin at 0.75 kg ha<sup>-1</sup> in succeeding yellow sarson with zero tillage resulted in effective weed management and higher productivity of yellow sarson in lateritic soil of West Bengal.

**Keywords:** Direct seeded rice, herbicides, soil mulch, yellow sarson, weed management

### Introduction

In the Indo-Gangetic Plains (IGP), rice (*Oryza sativa* L.)-yellow sarson (*Brassica campestris* L var. yellow sarson) is the widely adopted cropping system practiced by the farmers. Over 250 cropping systems are believed to exist in India. Approximately, 30 cropping systems have been recognized as significant based on a rationale for crop distribution (Su *et al.*, 2022) [1]. The rice-based cropping system is the most widely used cropping system in India. The availability of modern management approaches might render crop diversification and cropping systems that have higher water productivity, economic profitability, and long-term sustainability more feasible in this regard. By using an intensification method based on resource availability, adding legumes and oilseeds can not only improve soil fertility but also greatly increase profitability and production. In India, rapeseed-mustard is grown on 8.63 million hectares (Mha) with a total

production of 12.61 Mt in 2024-2025, whereas rice is grown on an area of about 51.42 Mha with a production of 149.07 Mt. West Bengal covers 0.64 Mha, produces 0.79 Mt (7.38% and 6.32% of all rapeseed mustard production in India, respectively) and occupies fifth in the ranking in major oilseed producing state in India (Anonymous, 2025)<sup>[2]</sup>.

Direct seeding currently accounts for about one-third of the world's rice cultivation area. Due to several constraints, yellow sarson productivity in the rice-yellow sarson system is significantly lower than its potential production. The primary causes are delayed sowing due to previous long-duration rice varieties being harvested later than anticipated, and soil wetness and moisture stress during important crop growth phases, which reduces yield (Duary *et al.*, 2016)<sup>[3]</sup>. In Eastern India, the *rabi* season is characterized by a short, mild winter. One of the primary concerns of growing *rabi* crops is making the most use of the short and mild winter. In eastern India, rapeseed (*Brassica* spp.) growing on rainfed rice fallow areas offers a bright prospective for the future. Utilizing the soil's remaining moisture, which enhances cropping intensity by encouraging rapeseed development in irrigated rice systems, makes this approach feasible (NAAS, 2013)<sup>[4]</sup>. As a result, rice-rapeseed agriculture has become a common cropping technique for a significant number of farmers in Eastern India. Weeds are the main biological barrier that threatens the development and application of direct seeded rice systems, causing yield losses of 50-91 percent (Rao *et al.*, 2007<sup>[5]</sup>; Duary *et al.*, 2016<sup>[3]</sup>; Chakraborti *et al.*, 2017a<sup>[6]</sup>) in rice and approximately 15- 30% yield reduction in mustard crop (Mishra *et al.*, 2016)<sup>[7]</sup>.

DSR can be established by either sowing in moist soil (soil mulch sowing) or dry soil followed by irrigation (Sudhir *et al.*, 2013)<sup>[8]</sup>. Soil mulch sowing is a simple management technique that comprises of pre-sowing irrigation and shallow tillage (to break soil capillaries and form soil mulch) before rice seeding in order to improve weed control and reduce evaporative losses. By lowering the need for early irrigation, soil mulch sowing makes it possible to sow DSR two to three weeks prior to the start of the monsoon, when rice can be established and the risk of stand mortality from inundation from the monsoon rains is minimized (Sarangi *et al.*, 2020)<sup>[9]</sup>. Furthermore, by quickly drying the top 2 cm of the soil—where the majority of weeds establish—soil mulching is believed to reduce weed establishment. In addition, moisture below 2 cm is retained within, which promotes healthy rice establishment and reduces the need for early irrigation.

In regions of rice cultivations, herbicides are very effective and economical tools, which are commonly utilized to control weeds because of a labor shortage (Singh *et al.*, 2016; Verma *et al.*, 2016; Nagarjun *et al.*, 2019)<sup>[10, 11, 12]</sup>. The growth of succeeding crops is affected by herbicide residue in the soil (Malik and Duary, 2013; Upasani *et al.*, 2017 and Mondal *et al.*, 2019)<sup>[13, 14, 15]</sup>. The choice of herbicide must therefore be solely determined by the prevailing cropping pattern in that region. Herbicides used on a prior crop may have a residual effect on weed growth in the subsequent crop (Malik and Duary, 2013; Chakraborti *et al.*, 2017b; Sathyapriya and Chinnusamy, 2020)<sup>[13, 16, 17]</sup>. Keeping all in view, the present investigation was carried out with an objective to study the effect of weed management practices with and without soil mulch followed in direct seeded rice on the weeds and yield of succeeding yellow sarson crop grown as zero tillage.

## Materials and Methods

### Experimental period and location

A field study was carried out in the DSR-yellow sarson cropping

system in 2021-2022, during the wet and *rabi* seasons. The experimental site is situated at the Agricultural Farm of Institute of Agriculture at Visva-Bharati University in West Bengal, India, at latitude 23°40'09"N and longitude 87°39'30"E. The field is located in the sub-humid red and lateritic agro-ecological zone of the tropics, with an average elevation of 81 meters above mean sea level. The experimental field's soil was Ultisol, which had a sandy loam texture, low organic carbon (0.39%), low available nitrogen (235.6 kg ha<sup>-1</sup>), medium available potassium (23.75 kg ha<sup>-1</sup>), and medium available potassium (162.45 kg ha<sup>-1</sup>). The pH of soil was 5.72 (acidic), measured in a 1:2.5 soil to water ratio.

### Experimental design and treatments details

The experiment was conducted in a split-plot design, with two mulching practices viz., soil mulch sowing and no mulch sowing applied in preceding crop DSR in the main plot and five weed management practices in the sub plot, which were replicated thrice. As a sequential crop yellow sarson was sown under zero tillage without much disturbance of the soil. Each yellow sarson subplot of the preceding DSR was split into two equal halves. A portion was set aside to study the impact of treatments used in the preceding DSR on subsequent yellow sarson, and the other portion was treated with pre-emergence application of the recommended herbicide pendimethalin (Dhanutop 30 EC) at 0.75 kg ha<sup>-1</sup>.

Hence, the ten sub plot treatments in yellow sarson were PE oxadiargyl at 90 g ha<sup>-1</sup> in DSR *fb* no application of herbicide in yellow sarson; PE oxadiargyl at 90 g ha<sup>-1</sup> in DSR *fb* PE pendimethalin at 0.75 kg ha<sup>-1</sup> in yellow sarson; PoE bispyribac sodium at 25 g ha<sup>-1</sup> in DSR *fb* no application of herbicide in yellow sarson; PoE bispyribac sodium at 25 g ha<sup>-1</sup> in DSR *fb* PE pendimethalin at 0.75 kg ha<sup>-1</sup> in yellow sarson; PE oxadiargyl at 90 g ha<sup>-1</sup> *fb* PoE bispyribac sodium at 25 g ha<sup>-1</sup> in DSR *fb* no application of herbicide in yellow sarson; PE oxadiargyl at 90 g ha<sup>-1</sup> *fb* PoE bispyribac sodium at 25 g ha<sup>-1</sup> in DSR *fb* PE pendimethalin at 0.75 kg ha<sup>-1</sup> in yellow sarson; PoE application of premix triafamone 20% + ethoxysulfuron 10% at 60g ha<sup>-1</sup> in DSR *fb* no application of herbicide in yellow sarson; PoE premix triafamone 20% + ethoxysulfuron 10% at 60g ha<sup>-1</sup> in DSR *fb* PE pendimethalin at 0.75 kg ha<sup>-1</sup> in yellow sarson; untreated control in DSR *fb* no application of herbicide in yellow sarson and untreated control in DSR *fb* PE pendimethalin at 0.75 kg ha<sup>-1</sup> in yellow sarson.

### Crop management and recording of observations

For the seeding of yellow sarson, the plot areas were left undisturbed. The yellow sarson plots were manually sown during the second week of November. This was done by using a wrinkle-type tiny shovel to open the little furrow, then applying fertilizer in the lower layer and seeds in the upper layer in a continuous line with a 30-cm row-to-row spacing to prevent disturbing the layout. Then, at 15 DAS, a thinning operation was carried out to keep the space between plants at 10 cm. Pendimethalin was applied to the yellow sarson crop using a battery-operated backpack sprayer with a flat fan nozzle and a 500 liter spray volume per hectare, as per treatments. The yellow sarson cultivar “B-9” was used in the present experiment. The crop was fertilized with 80:40:40 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O ha<sup>-1</sup> in the form of urea, single super phosphate and muriate of potash, respectively. Half amount of nitrogen and full dose of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were applied as basal at the time of sowing. The remaining dose of nitrogen was top dressed at the 30 DAS

The biomass and species wise weed density (represented as no.

m<sup>-2</sup>) were determined by counting and collecting all weeds within 50 cm × 50 cm quadrats from each plot's designated sampling area. Weed biomass was then calculated and represented in g m<sup>-2</sup> after the weeds were gathered and dried in a hot air oven at 70 to 75°C. Yellow sarson was harvested as soon as 80 per cent siliquae turn yellowish brown to prevent shattering. The yield of both seed and stick was recorded and expressed in kg ha<sup>-1</sup>.

### Methods of statistical analysis

The square root [ $\sqrt{X+0.5}$ ] transformation was made applicable to the weed data, and the resulting data was then used for analysis. The data was statistically analyzed at a 5% level of significance, following the procedure as described by Gomez and Gomez (1984) [18]. The table on weed datas includes both the transformed values and the original data in parenthesis.

## Results and Discussion

### Effect on weeds

The yellow sarson field was infested with *Cynodon dactylon* (L.) Pers. and *Digitaria sanguinalis* (L.) Scop. among grasses and *Eclipta alba* (L.) Hassk. *Gnaphalium indicum* (L.), *Polygonum plebeium* (R. Br.) and *Spilanthes calva* among broadleaved weeds. Teja and Duary (2018) [19] and Sar *et al.* (2025) [20] have documented a similar composition of weed flora in yellow sarson in this region.

The total weed density was significantly lower under sowing after pre-sowing irrigation (soil mulch), irrespective of herbicidal treatments. At 60 DAS, the densities of *D. sanguinalis*, *C. dactylon*, *S. calva*, *G. indicum*, *P. plebeium* and *E. alba* was reduced by 42.09, 24.04, 43.08, 41.83, 55.09 and 71.20%, respectively, (Table 1) under the sowing with soil mulch method than in no mulch sowing. Untreated control in DSR *fb* no application of herbicide in yellow sarson plots registered the highest densities of most of the weed species at 60 DAS. Among different weed management practices, sequential application of PE oxadiargyl at 90 g ha<sup>-1</sup> *fb* PoE bispyribac sodium at 25 g ha<sup>-1</sup> in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson was found to be significantly superior over the others in reducing the density of *D. sanguinalis*, *C. dactylon* and *S. calva* at 60 DAS. The densities of *G. indicum*, *P. plebeium* and *E. alba* at 60 DAS, were also effectively reduced by the application of premix triafamone 20% + ethoxysulfuron 10% at 60g ha<sup>-1</sup> (PoE) alone in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson and oxadiargyl at 90 g ha<sup>-1</sup> (PE) *fb* bispyribac sodium at 25 g ha<sup>-1</sup> (PoE) in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson.

The biomass of *D. sanguinalis*, *C. dactylon*, *S. calva*, *G. indicum*, *P. plebeium* and *E. alba* were 28.85, 11.98, 38.92, 25.19, 47.03 and 68.85% lower, respectively under sowing with soil mulch method than no mulch (Table 2). Among weed management treatments, oxadiargyl at 90 g ha<sup>-1</sup> (PE) *fb* bispyribac sodium at 25 g ha<sup>-1</sup> (PoE) in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson significantly reduced the biomass of the grassy species viz., *D. sanguinalis*, *C. dactylon* at 60 DAS. Grassy weeds, *D. sanguinalis* and *C. dactylon* together accumulated the highest total weed biomass at 60 DAS under untreated control in DSR *fb* no application of herbicide in yellow sarson. Oxadiargyl at 90 g ha<sup>-1</sup> (PE) *fb* bispyribac sodium at 25 g ha<sup>-1</sup> (PoE) in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson resulted in 91.88 and 68.64% reduction of biomass of *D. sanguinalis* and *C. dactylon*, respectively, over untreated control in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson. The application of premix triafamone 20% +

ethoxysulfuron 10% at 60g ha<sup>-1</sup> (PoE) alone in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson and sequential application of oxadiargyl at 90 g ha<sup>-1</sup> (PE) *fb* bispyribac sodium at 25 g ha<sup>-1</sup> (PoE) in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson effectively reduced the biomass of *S. calva*, *P. plebeium* and *E. alba* at 60 DAS.

Soil mulch sowing effectively reduced both weed density and biomass across all major weed species. This aligns with previous findings that mulching acts as a physical barrier, limiting light availability and altering soil temperature and moisture conditions, thereby inhibiting weed germination and growth (Chauhan *et al.*, 2012) [21]. The results are in conformity with the findings on sowing with soil mulch reducing early weed pressure (IRRI, 2020) [22]. Verma *et al.* (2016) [11]; Kumar *et al.* (2022) [23] and Pramanik *et al.* (2025) [24], reported similar results on dust mulching in lowering density and dry weight of weed species. The combination likely provided by both pre- and post-emergence control, targets a broad spectrum of weed flora. Similar results of pendimethalin on efficiently suppressing weeds were reported by Teja and Duary (2018) [19] and Sar *et al.* (2025) [20] in yellow sarson in this region.

### Effect on yellow sarson

Soil mulch sowing registered significantly higher siliquae plant<sup>-1</sup> and number of seeds siliquae<sup>-1</sup> than no soil mulch sowing. The siliquae plant<sup>-1</sup> and number of seeds siliqua<sup>-1</sup> was 18.29% and 10.33% higher (Table 3) under soil mulch sowing than no soil mulch, respectively. There was no significant difference between sowing methods in test weight of yellow sarson. However, test weight varied significantly due to weed management practices. The highest test weight of yellow sarson was observed under oxadiargyl at 90 g ha<sup>-1</sup> (PE) *fb* bispyribac sodium at 25 g ha<sup>-1</sup> (PoE) in DSR *fb* pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson treatment which was significantly superior over unweeded control in DSR *fb* no herbicide in yellow sarson. Most of other weed management practices were on par with the highest one with respect to test weight. Oxadiargyl at 90 g ha<sup>-1</sup> (PE) *fb* bispyribac sodium at 25 g ha<sup>-1</sup> (PoE) in DSR *fb* pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson registered the highest siliquae plant<sup>-1</sup> and number of seeds siliqua<sup>-1</sup> (Table 3). The findings indicate that timely and effective weed management techniques, such as applying pre-emergence or post emergence herbicide, effectively suppressed dominant weeds that emerged in the early stages of crop growth, promoting the formation of branches and siliquae, growth characteristics, and the partitioning of dry matter towards formation of seed.

The seed and stick yields of yellow sarson under the soil mulch sowing method were about 6.84 and 6.89% higher than those under the no-soil mulch sowing method (Table 3). This is most likely because soil mulching effectively controls weeds. Among weed management treatments, irrespective of the sowing methods, seed and stick yield were the highest with sequential application of PE oxadiargyl at 90 g ha<sup>-1</sup> (PE) *fb* PoE bispyribac sodium at 25 g ha<sup>-1</sup> (PoE) in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson, which was statistically on par with premix triafamone 20% + ethoxysulfuron 10% at 60g ha<sup>-1</sup> (PoE) alone in DSR and pendimethalin at 0.75 kg ha<sup>-1</sup> (PE) in yellow sarson. This suggests that effective weed suppression during the critical crop-weed competition period is essential for obtaining higher yield potential. Weed control strategies significantly boosted the seed and stick yield of yellow sarson confirming with the findings of Teja and Duary (2018) [19] and Sar and Duary (2022) [25].

**Table 1:** Effect of soil mulch and weed management practices on species wise weed density at 60 DAS

| Treatments                                                 | Weed density (No. m <sup>-2</sup> ) at 60 DAS |                         |                         |                           |                           |                     |
|------------------------------------------------------------|-----------------------------------------------|-------------------------|-------------------------|---------------------------|---------------------------|---------------------|
|                                                            | <i>Digitaria sanguinalis</i>                  | <i>Cynodon dactylon</i> | <i>Spilanthus calva</i> | <i>Gnaphalium indicum</i> | <i>Polygonum plebeium</i> | <i>Eclipta alba</i> |
| <b>Mulching practices</b>                                  |                                               |                         |                         |                           |                           |                     |
| Sowing after pre-sowing irrigation (soil mulch sowing)     | 4.33<br>(18.3)                                | 3.37<br>(10.9)          | 3.25<br>(10.0)          | 2.51<br>(5.8)             | 3.08<br>(9.0)             | 1.95<br>(3.3)       |
| Sowing followed by (fb) irrigation (no soil mulch)         | 5.67<br>(31.62)                               | 3.85<br>(14.35)         | 4.25<br>(17.57)         | 3.24<br>(9.97)            | 4.58<br>(20.45)           | 3.46<br>(11.46)     |
| S. Em(±)                                                   | 0.15                                          | 0.04                    | 0.07                    | 0.10                      | 0.06                      | 0.08                |
| LSD(P=0.05)                                                | 0.88                                          | 0.24                    | 0.43                    | 0.62                      | 0.39                      | 0.51                |
| <b>Weed management practices</b>                           |                                               |                         |                         |                           |                           |                     |
| Oxadiargylin DSR fb no herbicide in YS                     | 6.19<br>(37.77)                               | 3.99<br>(15.43)         | 4.75<br>(22.05)         | 3.68<br>(13.08)           | 4.67<br>(21.30)           | 4.90<br>(23.50)     |
| Oxadiargylin DSR fb pendimethalin in YS                    | 4.91<br>(23.57)                               | 2.26<br>(4.59)          | 2.78<br>(7.25)          | 0.71<br>(0.00)            | 2.75<br>(7.09)            | 1.96<br>(3.33)      |
| Bispyribac-sodium in DSR fb no herbicide in YS             | 5.92<br>(34.53)                               | 5.12<br>(25.72)         | 4.44<br>(19.20)         | 5.71<br>(32.11)           | 2.90<br>(7.89)            | 3.67<br>(12.96)     |
| Bispyribac-sodium in DSR fb pendimethalin in YS            | 2.21<br>(4.38)                                | 3.58<br>(12.29)         | 2.43<br>(5.40)          | 1.55<br>(1.89)            | 2.64<br>(6.46)            | 1.08<br>(0.66)      |
| Oxadiargylfbispyribac-sodium in DSR fb no herbicide in YS  | 6.64<br>(43.61)                               | 2.75<br>(7.07)          | 4.19<br>(17.09)         | 2.74<br>(6.99)            | 5.28<br>(27.34)           | 4.03<br>(15.72)     |
| Oxadiargylfbispyribac-sodium in DSR fb pendimethalin in YS | 1.68<br>(2.32)                                | 1.94<br>(3.27)          | 2.62<br>(6.35)          | 1.78<br>(2.66)            | 2.52<br>(5.84)            | 1.81<br>(2.77)      |
| Triafamone + ethoxysulfuron in DSR fb no herbicide in YS   | 5.40<br>(28.71)                               | 5.38<br>(28.45)         | 4.77<br>(22.28)         | 4.46<br>(19.36)           | 4.93<br>(23.84)           | 3.46<br>(11.49)     |
| Triafamone + ethoxysulfuron in DSR fb pendimethalin in YS  | 3.87<br>(14.45)                               | 2.90<br>(7.90)          | 2.66<br>(6.57)          | 1.69<br>(2.35)            | 1.78<br>(2.68)            | 1.41<br>(1.50)      |
| Unweeded control in DSR fb no herbicide in YS              | 8.54<br>(72.49)                               | 5.02<br>(24.72)         | 5.96<br>(35.00)         | 5.74<br>(32.45)           | 6.72<br>(44.64)           | 3.31<br>(10.47)     |
| Unweeded control in DSR fb pendimethalin in YS             | 4.65<br>(21.11)                               | 3.20<br>(9.71)          | 2.89<br>(7.88)          | 0.71<br>(0.00)            | 4.10<br>(16.31)           | 1.41<br>(1.49)      |
| S.Em (±)                                                   | 0.20                                          | 0.14                    | 0.15                    | 0.13                      | 0.19                      | 0.15                |
| LSD(P=0.05)                                                | 0.58                                          | 0.41                    | 0.44                    | 0.37                      | 0.54                      | 0.42                |

\*Figures within parentheses indicate original values and the data were transformed to  $\sqrt{(X + 0.5)}$  before analysis; DAS = Day after sowing; DSR- Direct seeded rice; YS- Yellow sarson

**Table 2:** Effect of soil mulch and weed management practices on species wise weed biomass at 60 DAS

| Treatments                                                    | Weed biomass (g m <sup>-2</sup> ) at 60 DAS |                         |                         |                           |                           |                     |
|---------------------------------------------------------------|---------------------------------------------|-------------------------|-------------------------|---------------------------|---------------------------|---------------------|
|                                                               | <i>Digitaria sanguinalis</i>                | <i>Cynodon dactylon</i> | <i>Spilanthus calva</i> | <i>Gnaphalium indicum</i> | <i>Polygonum plebeium</i> | <i>Eclipta alba</i> |
| <b>Mulching practices</b>                                     |                                             |                         |                         |                           |                           |                     |
| Sowing after pre-sowing irrigation (soil mulch sowing)        | 3.05<br>(8.78)                              | 2.13<br>(4.04)          | 2.08<br>(3.83)          | 1.56<br>(1.93)            | 1.32<br>(1.25)            | 1.08<br>(0.70)      |
| Sowing followed by (fb) irrigation (no soil mulch)            | 3.58 (12.34)                                | 2.26 (4.59)             | 2.60 (6.27)             | 1.75 (2.58)               | 1.69 (2.36)               | 1.60 (2.05)         |
| S. Em(±)                                                      | 0.11                                        | 0.10                    | 0.06                    | 0.06                      | 0.03                      | 0.03                |
| LSD(P=0.05)                                                   | NS                                          | NS                      | 0.36                    | NS                        | 0.16                      | 0.17                |
| <b>Weed management practices</b>                              |                                             |                         |                         |                           |                           |                     |
| Oxadiargyl in DSR fb no herbicide in YS                       | 4.08 (16.17)                                | 2.85 (7.61)             | 3.30 (10.42)            | 1.46 (1.62)               | 1.35 (1.32)               | 1.92 (3.19)         |
| Oxadiargyl in DSR fb pendimethalin in YS                      | 3.13 (9.29)                                 | 1.98 (3.42)             | 1.74 (2.52)             | 0.71 (0.00)               | 1.24 (1.04)               | 1.22 (0.98)         |
| Bispyribac-sodium in DSR fb no herbicide in YS                | 5.24 (26.93)                                | 2.83 (7.52)             | 2.48 (5.67)             | 3.47 (11.52)              | 1.41 (1.48)               | 1.85 (2.9)          |
| Bispyribac-sodium in DSR fb pendimethalin in YS               | 1.47 (1.67)                                 | 2.00 (3.5)              | 1.47 (1.66)             | 1.11 (0.73)               | 1.27 (1.11)               | 0.78 (0.11)         |
| Oxadiargyl fb bispyribac-sodium in DSR fb no herbicide in YS  | 3.69<br>(13.14)                             | 1.66<br>(2.24)          | 2.75<br>(7.07)          | 1.61<br>(2.08)            | 2.01<br>(3.55)            | 1.85<br>(2.9)       |
| Oxadiargyl fb bispyribac-sodium in DSR fb pendimethalin in YS | 1.06<br>(0.62)                              | 1.09<br>(0.69)          | 1.77<br>(2.63)          | 0.95<br>(0.41)            | 0.97<br>(0.44)            | 0.91<br>(0.33)      |
| Triafamone + ethoxysulfuron in DSR fb no herbicide in YS      | 3.76<br>(13.66)                             | 2.61<br>(6.31)          | 2.87<br>(7.75)          | 2.00<br>(3.49)            | 1.68<br>(2.33)            | 1.46<br>(1.64)      |
| Triafamone + ethoxysulfuron in DSR fb pendimethalin in YS     | 2.47<br>(5.61)                              | 1.99<br>(3.47)          | 1.58<br>(2.00)          | 1.36<br>(1.34)            | 0.91<br>(0.32)            | 0.87<br>(0.25)      |
| Unweeded control in DSR fb no herbicide in YS                 | 5.38 (28.47)                                | 3.27 (10.19)            | 3.05 (8.81)             | 3.20 (9.73)               | 2.68 (6.67)               | 1.37 (1.37)         |
| Unweeded control in DSR fb pendimethalin in YS                | 2.85<br>(7.64)                              | 1.64<br>(2.20)          | 2.40<br>(5.25)          | 0.71<br>(0.00)            | 1.56<br>(1.94)            | 1.13<br>(0.77)      |
| S.Em (±)                                                      | 0.19                                        | 0.08                    | 0.11                    | 0.11                      | 0.05                      | 0.08                |
| LSD(P=0.05)                                                   | 0.55                                        | 0.24                    | 0.31                    | 0.30                      | 0.16                      | 0.22                |

\*Figures within parentheses indicate original values and the data were transformed to  $\sqrt{(X + 0.5)}$  before analysis; DAS = Day after sowing; DSR- Direct seeded rice; YS- Yellow sarson

**Table 3:** Effect of soil mulch and weed management practices on yield attributes and yield of yellow sarson

| Treatments                                                 | Siliquae<br>(No. plant <sup>-1</sup> ) | Seeds siliqua <sup>-1</sup> | Test weight(g) | Seed yield<br>(kg ha <sup>-1</sup> ) | Stick yield<br>(kg ha <sup>-1</sup> ) |
|------------------------------------------------------------|----------------------------------------|-----------------------------|----------------|--------------------------------------|---------------------------------------|
| <b>Mulchingpractices</b>                                   |                                        |                             |                |                                      |                                       |
| Sowing after pre-sowing irrigation (soil mulch sowing)     | 77.6                                   | 23.5                        | 3.19           | 1482                                 | 4233                                  |
| Sowing followed by (fb) irrigation (no soil mulch)         | 65.6                                   | 21.3                        | 3.16           | 1387                                 | 3960                                  |
| <b>S.Em(±)</b>                                             | 0.87                                   | 0.33                        | 0.04           | 16.75                                | 63.56                                 |
| <b>LSD(P=0.05)</b>                                         | 5.32                                   | 2.01                        | NS             | NS                                   | NS                                    |
| <b>Weedmanagementpractices</b>                             |                                        |                             |                |                                      |                                       |
| Oxadiargylin DSR fb no herbicide in YS                     | 72.3                                   | 21.8                        | 3.14           | 1417                                 | 4058                                  |
| Oxadiargylin DSR fb pendimethalin in YS                    | 70.9                                   | 23.9                        | 3.26           | 1535                                 | 4565                                  |
| Bispyribac-sodium in DSR fb no herbicide in YS             | 66.5                                   | 22.1                        | 3.26           | 1333                                 | 3584                                  |
| Bispyribac-sodium in DSR fb pendimethalin in YS            | 71.3                                   | 24.0                        | 3.25           | 1372                                 | 4032                                  |
| Oxadiargylfbispyribac-sodium in DSR fb no herbicide in YS  | 73.4                                   | 21.2                        | 3.09           | 1258                                 | 3630                                  |
| Oxadiargylfbispyribac-sodium in DSR fb pendimethalin in YS | 86.5                                   | 24.7                        | 3.30           | 1737                                 | 4821                                  |
| Triafamone + ethoxysulfuron in DSR fb no herbicide in YS   | 66.1                                   | 21.8                        | 3.05           | 1317                                 | 3700                                  |
| Triafamone + ethoxysulfuron in DSR fb pendimethalin in YS  | 75.0                                   | 22.9                        | 3.16           | 1625                                 | 4632                                  |
| Unweeded control in DSR fb no herbicide in YS              | 56.6                                   | 20.1                        | 3.03           | 1220                                 | 3472                                  |
| Unweeded control in DSR fb pendimethalin in YS             | 77.8                                   | 21.7                        | 3.17           | 1532                                 | 4470                                  |
| <b>S.Em (±)</b>                                            | 2.65                                   | 0.48                        | 0.05           | 59.35                                | 156.40                                |
| <b>LSD(P=0.05)</b>                                         | 7.59                                   | 1.36                        | 0.16           | 170.21                               | 448.52                                |

DSR- Direct seeded rice: YS- Yellow sarson

## Conclusion

Based on above findings, it can be concluded that the integrated use of soil mulch sowing of DSR along with either sequential application of PE oxadiargyl at 90 g ha<sup>-1</sup> fb PoE bispyribac sodium at 25g ha<sup>-1</sup> or sole PoE application of premix triafamone 20% + ethoxysulfuron 10% at 60 g ha<sup>-1</sup> in DSR and PE pendimethalin at 0.75 kg ha<sup>-1</sup> in yellow sarson with zero tillage appeared to be promising for effective weed management and higher productivity of succeeding yellow sarson in lateritic soil of West Bengal.

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