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## Management of grassy weeds in *kharif niger* (*Guizotia abyssinica* (L.f.) Cass.)

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### Abstract

A field experiment was conducted during the *kharif* season of 2025 at the ICAR–Indian Institute of Oilseeds Research (IIOR), Rajendranagar, Hyderabad, to evaluate integrated weed management practices in *kharif niger*. The experiment was laid out in a randomized block design with twelve treatments and three replications. The treatments comprised pre-emergence application of pendimethalin 30% EC @ 0.75 kg a.i. ha<sup>-1</sup>, pyroxasulfone 85% WG @ 127.5 g a.i. ha<sup>-1</sup> and pendimethalin + imazethapyr 2% EC @ 480, 720 and 960 g a.i. ha<sup>-1</sup>, each followed by hand weeding at 30 DAS, pre-emergence application of pendimethalin 30% EC @ 0.75 kg a.i. ha<sup>-1</sup> or pyroxasulfone 85% WG @ 127.5 g a.i. ha<sup>-1</sup> followed by post-emergence application of clethodim 25% EC @ 120 g a.i. ha<sup>-1</sup> or haloxyfop-R-methyl 10.5% EC @ 108 g a.i. ha<sup>-1</sup>, hand weeding at 20 and 40 DAS, weedy check and weed-free check. Weed management practices significantly influenced grass and total weed control efficiency, plant height and seed yield per plant. Hand weeding at 20 and 40 DAS recorded the highest total and grass weed control efficiency at 30 DAS (83.93 and 75.00%, respectively), and the highest plant height (163.33 cm) and seed yield per plant (1.87 g) among the weed management treatments. During the later stages of crop growth, pre-emergence application of pendimethalin + imazethapyr 2% EC @ 720 and 960 g a.i. ha<sup>-1</sup>, each followed by hand weeding at 30 DAS, maintained weed control efficiency and produced plant height and seed yield per plant comparable with hand weeding at 20 and 40 DAS. Among the herbicide-based weed management practices, pre-emergence application of pendimethalin + imazethapyr 2% EC @ 720 and 960 g a.i. ha<sup>-1</sup>, each followed by hand weeding at 30 DAS, was the most effective in maintaining higher weed control efficiency, plant height and seed yield per plant in *kharif niger*.

**Keywords:** Integrated weed management, herbicides, weed control efficiency, niger

### 1. Introduction

Niger (*Guizotia abyssinica* (L.f.) Cass.), commonly known as ramtil, is an important minor oilseed crop (Gomashe *et al.* 2025) <sup>[1]</sup> belonging to the family Asteraceae and is cultivated mainly in India and Ethiopia. India is the world's leading producer and exporter of niger, contributing nearly 3% of the country's total oilseed production (Deme *et al.*, 2017; Baghel *et al.*, 2018) <sup>[2, 3]</sup>. The crop is valued for its seeds, which contain 32-40% high-quality edible oil and 18–24% protein. The oil contains nearly 70% unsaturated fatty acids, possesses excellent keeping quality and is free from toxic compounds, making it highly suitable for human consumption. Besides its edible value, niger oil is used in the cosmetic and pharmaceutical industries, while the oilcake serves as a nutritious livestock feed. The crop is also valued as a green manure and an important bee forage. In addition, niger seeds are exported for use in the international bird feed market. Owing to its remarkable adaptability to rainfed, low-input production systems, niger performs well under poor soil fertility and moisture-stress conditions and is therefore cultivated mainly on marginal and sub-marginal lands, particularly in the tribal regions of India, where it is regarded as the lifeline of tribal agriculture and economy (Ranganatha, 2013) <sup>[4]</sup>.

In India, annual niger production is about 0.14 lakh tonnes with an average productivity of 284 kg ha<sup>-1</sup>, with Chhattisgarh accounting for the largest share of area and production (Indiastat, 2025) <sup>[5]</sup>. Despite its adaptability and economic importance, the productivity of niger remains low because it is predominantly cultivated under marginal, rainfed and low-input conditions, coupled with several biotic and abiotic constraints. Among the biotic constraints, weed infestation is one of the major factors limiting niger productivity. Weeds compete with the crop for water, nutrients,

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light and space, resulting in yield losses of up to 85% (Oimbo *et al.*, 2018) <sup>[6]</sup>. The crop is most vulnerable to weed competition during the first 30–45 days after sowing (DAS), which constitutes the critical period of crop–weed competition (Paikray *et al.*, 2000) <sup>[7]</sup>. Niger fields harbour a diverse weed flora comprising grasses, sedges, broad-leaved weeds and parasitic weeds (Sahoo *et al.*, 2025) <sup>[8]</sup>. The presence of diverse weed groups highlights the need for timely and effective weed management to minimize crop–weed competition and realize the yield potential of niger. Despite the importance of timely weed management, information on effective grassy weed management practices in *kharif* niger remains limited. Although manual and mechanical weed control are effective, their adoption is increasingly constrained by labour scarcity, rising labour wages and untimely rainfall (Duary and Mukherjee, 2013) <sup>[9]</sup>. Consequently, integrated weed management (IWM), involving the integration of herbicides with appropriate cultural and mechanical methods, offers a practical, efficient and sustainable approach for managing grassy weeds (Baliyar and Dahiya, 2024) <sup>[10]</sup>. Therefore, the present study was undertaken to identify an effective integrated weed management strategy for suppressing grassy weeds and improving the productivity of *kharif* niger.

## 2. Materials and Methods

The experiment was conducted during the *kharif* season of 2025 at the ICAR–Indian Institute of Oilseeds Research (IIOR), Rajendranagar, Hyderabad. The experimental site (17°31' N latitude and 78°41' E longitude; 551.46 m above mean sea level) is located in the Southern Telangana Agro-climatic Zone. The region is characterized by a semi-arid tropical climate, receiving most of its rainfall during the Southwest monsoon season. During the crop growth period, a total rainfall of 775.9 mm was received over 45 rainy days. The experimental soil was sandy loam, well drained and slightly alkaline (pH 7.75), with medium organic carbon content (0.54%). The available nitrogen (291.20 kg ha<sup>-1</sup>) and phosphorus (15.38 kg ha<sup>-1</sup>) contents were in the medium range, whereas available potassium content was high (310.22 kg ha<sup>-1</sup>). The niger variety Utkal Niger-150 (ONS-150) was sown on 18 July 2025 at a spacing of 45 cm × 15 cm using a seed rate of 5 kg ha<sup>-1</sup>. Recommended fertilizer dose of 40:40:20 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O ha<sup>-1</sup> was applied, with 50% nitrogen and the full dose of phosphorus and potassium applied as basal, while the remaining 50% nitrogen was top-dressed three weeks after sowing. The experiment was laid out in a randomized block design with twelve treatments and three replications. The treatments consisted of pendimethalin 30% EC @ 0.75 kg a.i. ha<sup>-1</sup> as PE *fb* HW at 30 DAS (T<sub>1</sub>), pyroxasulfone 85% WG @ 127.5 g a.i. ha<sup>-1</sup> as PE *fb* HW at 30 DAS (T<sub>2</sub>), pendimethalin 30% + imazethapyr 2% EC @ 480 g a.i. ha<sup>-1</sup> as PE *fb* HW at 30 DAS (T<sub>3</sub>), pendimethalin 30% EC @ 0.75 kg a.i. ha<sup>-1</sup> as PE *fb* clethodim 25% EC @ 120 g a.i. ha<sup>-1</sup> as PoE (T<sub>4</sub>), pyroxasulfone 85% WG @ 127.5 g a.i. ha<sup>-1</sup> as PE *fb* clethodim 25% EC @ 120 g a.i. ha<sup>-1</sup> as PoE (T<sub>5</sub>), pendimethalin 30% + imazethapyr 2% EC @ 720 g a.i. ha<sup>-1</sup> as PE *fb* HW at 30 DAS (T<sub>6</sub>), pendimethalin 30% EC @ 0.75 kg a.i. ha<sup>-1</sup> as PE *fb* haloxyfop-R-methyl 10.5% EC @ 108 g a.i. ha<sup>-1</sup> as PoE (T<sub>7</sub>), pyroxasulfone 85% WG @ 127.5 g a.i. ha<sup>-1</sup> as PE *fb* haloxyfop-R-methyl 10.5% EC @ 108 g a.i. ha<sup>-1</sup> as PoE (T<sub>8</sub>), pendimethalin 30% + imazethapyr 2% EC @ 960 g a.i. ha<sup>-1</sup> as PE *fb* HW at 30 DAS (T<sub>9</sub>), hand weeding at 20 and 40 DAS (T<sub>10</sub>), weedy check (T<sub>11</sub>) and weed-free check (T<sub>12</sub>). Pre-emergence herbicides were applied within 24 hours of sowing, whereas post-emergence herbicides were applied at the 2–4 leaf stage of grassy weeds (20 DAS) using a knapsack sprayer fitted with a flat-fan nozzle calibrated to deliver a spray volume of 500 L ha<sup>-1</sup>. Hand

weeding was carried out at 20, 30 and 40 DAS in the respective treatments. In the weed-free check, weeds were removed manually to maintain weed-free conditions, whereas the weedy check was left undisturbed until harvest. Weed observations were recorded at 30 DAS, 60 DAS and harvest using a 0.25 × 0.25 m<sup>2</sup> quadrat placed randomly within each plot. Weeds occurring within the quadrat were identified and counted species-wise and weed density was expressed as number of weeds m<sup>-2</sup>. The crop was harvested at physiological maturity on 21 November 2025. Observations on weed parameters and yield were recorded following standard procedures. Seed and stalk yields were recorded from each plot and expressed as kg ha<sup>-1</sup>. Weed control efficiency (WCE) was calculated based on weed density using the formula proposed by Mani *et al.* (1973) <sup>[11]</sup>.

$$\text{WCE (\%)} = \frac{\text{WDC} - \text{WDT}}{\text{WDC}} \times 100$$

where WDC is weed density (number m<sup>-2</sup>) of control plot and WDT is weed density (number m<sup>-2</sup>) of treated plot.

The experimental data were subjected to analysis of variance (ANOVA) following the procedure described by Gomez and Gomez (1984) <sup>[12]</sup>. Treatment means were compared using the least significant difference (LSD) test at the 5% level of significance.

## 3. Results and Discussion

### 3.1 Weed control efficiency

#### 3.1.1 Weed control efficiency (Grasses)

Maximum weed control efficiency (WCE) at 30 DAS (Table 1) was recorded in T<sub>10</sub> (two hand weeding at 20 and 40 DAS), followed by T<sub>4</sub>, T<sub>5</sub>, T<sub>7</sub> and T<sub>8</sub>. Higher WCE under T<sub>10</sub> may be attributed to timely hand weeding, which effectively controlled the initial flush of grassy weeds and maintained lower grass weed density. Similar findings with two hand weeding were reported by Kamani *et al.* (2019) <sup>[13]</sup> in sesame. Likewise, the higher WCE observed under T<sub>4</sub>, T<sub>5</sub>, T<sub>7</sub> and T<sub>8</sub> may be ascribed to the sequential application of pre-emergence herbicides followed by post-emergence graminicides, which effectively reduced weed density of grasses during the early crop growth period. Similar findings on the effectiveness of post-emergence graminicides were reported by Singh *et al.* (2010) <sup>[14]</sup> in soybean and Sudhakara *et al.* (2014) <sup>[15]</sup> in groundnut, while the effectiveness of pre-emergence herbicides was reported by Dhanush *et al.* (2025) <sup>[16]</sup> in sesame and Singh *et al.* (2025) <sup>[17]</sup> in soybean.

At 60 DAS and at harvest, T<sub>10</sub>, T<sub>6</sub> and T<sub>9</sub> recorded the highest grass weed control efficiency. In contrast, T<sub>4</sub>, T<sub>5</sub>, T<sub>7</sub> and T<sub>8</sub> showed comparatively lower WCE during the later stages of crop growth, which could be ascertained to the limited residual activity of the post-emergence graminicides, allowing subsequent flushes of grassy weeds to emerge, thereby increasing grass weed density. Similar observations were reported by Rao (2013) <sup>[18]</sup> and Singh *et al.* (2023) <sup>[19]</sup> in blackgram. The sustained WCE recorded under T<sub>10</sub> might be due to two timely hand weeding, whereas the higher WCE under T<sub>6</sub> and T<sub>9</sub> may be attributed to the integration of pendimethalin + imazethapyr as a pre-emergence application followed by hand weeding at 30 DAS, which maintained lower grass weed density during the later stages of crop growth. Similar findings were reported by Yadav *et al.* (2025) <sup>[20]</sup> in groundnut.

#### 3.1.2 Weed control efficiency (Total weeds)

Weed management practices significantly influenced weed control efficiency (WCE) throughout the crop growth period (Table 1).

At 30 DAS, the highest WCE was recorded in T<sub>10</sub> (two hand weedings at 20 and 40 DAS), followed by T<sub>4</sub>, T<sub>7</sub>, T<sub>6</sub> and T<sub>9</sub>. The higher WCE under T<sub>10</sub> may be attributed to timely hand weeding, which effectively removed the initial flush of weeds during the early stage of crop growth. These findings corroborate with Kamani *et al.* (2019)<sup>[13]</sup> in sesame. Comparatively higher WCE observed under T<sub>4</sub> and T<sub>7</sub> may be attributed to the sequential application of pre-emergence herbicides followed by post-emergence graminicides, which effectively suppressed the weed flora during the early growth period. Similar findings on the effectiveness of haloxyfop-R-methyl were reported by Tiwari *et al.* (2007)<sup>[21]</sup> in soybean, whereas the effectiveness of clethodim was reported by Sudhakara *et al.* (2014)<sup>[15]</sup> in groundnut. Likewise, the higher WCE recorded under T<sub>6</sub> and T<sub>9</sub> may be attributed to the application of the premix herbicide pendimethalin + imazethapyr, which provided effective early-season weed suppression. Similar observations on the effectiveness of pendimethalin were further supported by the findings of Dhanush *et al.* (2025)<sup>[16]</sup> in sesame, whereas the

efficacy of the pendimethalin + imazethapyr premix was demonstrated by Yadav *et al.* (2025)<sup>[20]</sup> in groundnut.

At 60 DAS and at harvest, T<sub>10</sub>, T<sub>6</sub> and T<sub>9</sub> recorded the highest WCE. Sustained superiority of T<sub>10</sub> may be attributed to two timely hand weedings, which effectively controlled successive weed flushes throughout the crop growth period. Similarly, the higher WCE observed under T<sub>6</sub> and T<sub>9</sub> may be attributed to the integration of pre-emergence application of pendimethalin + imazethapyr with hand weeding at 30 DAS, which effectively suppressed surviving weeds and minimized subsequent weed emergence. In contrast, treatments involving pendimethalin or pyroxasulfone followed by post-emergence application of clethodim or haloxyfop-R-methyl recorded comparatively lower WCE during the later stages of crop growth. This may be attributed to the limited residual activity of the herbicides, which allowed subsequent weed emergence in the absence of later manual weeding. Similar observations were reported by Daramola *et al.* (2024)<sup>[22]</sup>.

**Table 1:** Effect of integrated weed management practices on grassy and total weed control efficiency (WCE) in *kharif* niger

| Treatments                                                                                                                                                     | WCE-Grasses (%) |        |            | WCE-Total (%) |        |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------|------------|---------------|--------|------------|
|                                                                                                                                                                | 30 DAS          | 60 DAS | At Harvest | 30 DAS        | 60 DAS | At Harvest |
| T <sub>1</sub> - Pendimethalin 30% EC @ 0.75 kg a.i. ha <sup>-1</sup> as PE <i>fb</i> HW at 30 DAS                                                             | 25.00           | 66.67  | 57.69      | 41.07         | 66.16  | 53.16      |
| T <sub>2</sub> - Pyroxasulfone 85% w/w WG @ 127.5 g a.i. ha <sup>-1</sup> as PE <i>fb</i> HW at 30 DAS                                                         | 33.33           | 61.11  | 50.00      | 28.57         | 60.00  | 46.84      |
| T <sub>3</sub> - Pendimethalin 30%+ Imazethapyr 2% EC @ 480 g a.i. ha <sup>-1</sup> as PE <i>fb</i> HW at 30 DAS                                               | 25.00           | 61.11  | 50.00      | 41.07         | 60.00  | 46.84      |
| T <sub>4</sub> - Pendimethalin 30% EC @ 0.75 kg a.i. ha <sup>-1</sup> as PE <i>fb</i> Clethodim 25% EC @ 120 g a.i. ha <sup>-1</sup> as PoE                    | 66.67           | 33.33  | 26.93      | 55.36         | 36.92  | 27.85      |
| T <sub>5</sub> - Pyroxasulfone 85% w/w WG @ 127.5 g a.i. ha <sup>-1</sup> as PE <i>fb</i> Clethodim 25% EC @ 120 g a.i. ha <sup>-1</sup> as PoE                | 66.67           | 33.33  | 23.08      | 35.72         | 36.92  | 24.05      |
| T <sub>6</sub> - Pendimethalin 30%+ Imazethapyr 2% EC @ 720 g a.i. ha <sup>-1</sup> as PE <i>fb</i> HW at 30 DAS                                               | 25.00           | 72.22  | 65.39      | 55.36         | 72.31  | 60.76      |
| T <sub>7</sub> - Pendimethalin 30% EC @ 0.75 kg a.i. ha <sup>-1</sup> as PE <i>fb</i> Haloxyfop-R-methyl 10.5% w/w EC @ 108 g a.i. ha <sup>-1</sup> as PoE     | 66.67           | 33.33  | 26.93      | 55.36         | 36.92  | 27.85      |
| T <sub>8</sub> - Pyroxasulfone 85% w/w WG @ 127.5 g a.i. ha <sup>-1</sup> as PE <i>fb</i> Haloxyfop-R-methyl 10.5% w/w EC @ 108 g a.i. ha <sup>-1</sup> as PoE | 66.67           | 33.33  | 26.93      | 35.72         | 36.92  | 27.85      |
| T <sub>9</sub> - Pendimethalin 30%+ Imazethapyr 2% EC @ 960 g a.i. ha <sup>-1</sup> as PE <i>fb</i> HW at 30 DAS                                               | 25.00           | 72.22  | 65.39      | 55.36         | 72.31  | 60.76      |
| T <sub>10</sub> - HW at 20 & 40 DAS                                                                                                                            | 75.00           | 72.22  | 65.39      | 83.93         | 72.31  | 60.76      |
| T <sub>11</sub> - Weedy check                                                                                                                                  | 0.00            | 0.00   | 0.00       | 0.00          | 0.00   | 0.00       |
| T <sub>12</sub> - Weed free check                                                                                                                              | -               | -      | -          | -             | -      | -          |

### 3.2 Plant height

Data pertaining to plant height at harvest as influenced by different weed management treatments are presented in Table 2. The weed free check (T<sub>12</sub>) recorded significantly greater plant height at harvest than all other treatments. Among the weed management treatments, the greater plant height recorded under T<sub>10</sub> may be attributed to timely weed removal through two hand weedings at 20 and 40 DAS, which effectively minimized crop-weed competition throughout the crop growth period and promoted sustained plant growth. Similar findings were reported by Singh *et al.* (2025)<sup>[17]</sup> in soybean, where two hand weedings at 20 and 40 DAS recorded higher plant height. Similarly, the higher plant height observed under T<sub>9</sub>, T<sub>6</sub> and T<sub>1</sub> may be attributed to effective weed suppression through the integration of pre-emergence herbicides (pendimethalin + imazethapyr or pendimethalin) with timely hand weeding, which provided favourable conditions for sustained crop growth. Similar findings were reported by Nivetha *et al.* (2022)<sup>[23]</sup> and Venu *et al.* (2022)<sup>[24]</sup> in sesame. In contrast, the reduced plant height recorded under the weedy check (T<sub>11</sub>) may be attributed to prolonged weed interference, which reduced the availability of moisture, nutrients, light and space, thereby limiting plant growth.

### 3.3 Seed yield per plant

Seed yield per plant varied significantly among the weed management treatments (Table 2).

The weed free check (T<sub>12</sub>) produced significantly higher seed yield per plant (2.14 g) than all other treatments. Among the weed management treatments, T<sub>10</sub> (hand weeding at 20 and 40 DAS) recorded the highest seed yield per plant (1.87 g) and remained statistically comparable with T<sub>9</sub> (1.84 g), T<sub>6</sub> (1.68 g) and T<sub>1</sub> (1.62 g). The higher seed yield per plant recorded under T<sub>10</sub> may be attributed to effective weed suppression during the critical period of crop-weed competition, which created favourable conditions for efficient utilization of growth resources and greater translocation of assimilates towards developing seeds. Similar findings were reported by Dhanush *et al.* (2025)<sup>[16]</sup> in sesame, where two hand weedings at 20 and 40 DAS resulted in higher seed yield. Likewise, the higher seed yield per plant recorded under T<sub>9</sub>, T<sub>6</sub> and T<sub>1</sub> may be attributed to effective weed suppression through the integration of pre-emergence herbicides (pendimethalin + imazethapyr or pendimethalin) with timely hand weeding, which ensured favourable conditions for efficient utilization of growth resources and enhanced seed development. Similar findings were reported by Dhankar *et al.* (2025)<sup>[25]</sup>. In

contrast, T<sub>11</sub> (weedy check) recorded the lowest seed yield per plant (0.82 g), probably due to severe weed competition

throughout the crop growth period, which adversely affected seed development

**Table 2:** Effect of integrated weed management practices on plant height and seed yield plant<sup>-1</sup> in *kharif* niger

| Treatments                                                                                                                                              | Plant height(cm) | Seed yield plant <sup>-1</sup> (g) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------|
| T <sub>1</sub> - Pendimethalin 30% EC @ 0.75 kg a.i. ha <sup>-1</sup> as PE fb HW at 30 DAS                                                             | 159.80           | 1.62                               |
| T <sub>2</sub> - Pyroxasulfone 85% w/w WG @ 127.5 g a.i. ha <sup>-1</sup> as PE fb HW at 30 DAS                                                         | 153.20           | 1.40                               |
| T <sub>3</sub> - Pendimethalin 30%+ Imazethapyr 2% EC @ 480 g a.i. ha <sup>-1</sup> as PE fb HW at 30 DAS                                               | 153.47           | 1.42                               |
| T <sub>4</sub> - Pendimethalin 30% EC @ 0.75 kg a.i. ha <sup>-1</sup> as PE fb Clethodim 25% EC @ 120 g a.i. ha <sup>-1</sup> as PoE                    | 143.47           | 1.12                               |
| T <sub>5</sub> - Pyroxasulfone 85% w/w WG @ 127.5 g a.i. ha <sup>-1</sup> as PE fb Clethodim 25% EC @ 120 g a.i. ha <sup>-1</sup> as PoE                | 141.93           | 1.08                               |
| T <sub>6</sub> - Pendimethalin 30%+ Imazethapyr 2% EC @ 720 g a.i. ha <sup>-1</sup> as PE fb HW at 30 DAS                                               | 160.60           | 1.68                               |
| T <sub>7</sub> - Pendimethalin 30% EC @ 0.75 kg a.i. ha <sup>-1</sup> as PE fb Haloxyfop-R-methyl 10.5% w/w EC @ 108 g a.i. ha <sup>-1</sup> as PoE     | 144.93           | 1.14                               |
| T <sub>8</sub> - Pyroxasulfone 85% w/w WG @ 127.5 g a.i. ha <sup>-1</sup> as PE fb Haloxyfop-R-methyl 10.5% w/w EC @ 108 g a.i. ha <sup>-1</sup> as PoE | 142.60           | 1.10                               |
| T <sub>9</sub> - Pendimethalin 30%+ Imazethapyr 2% EC @ 960 g a.i. ha <sup>-1</sup> as PE fb HW at 30 DAS                                               | 162.33           | 1.84                               |
| T <sub>10</sub> - HW at 20 & 40 DAS                                                                                                                     | 163.33           | 1.87                               |
| T <sub>11</sub> - Weedy check                                                                                                                           | 132.47           | 0.82                               |
| T <sub>12</sub> - Weed-free check                                                                                                                       | 170.53           | 2.14                               |
| SEm±                                                                                                                                                    | 2.3              | 0.09                               |
| CD (P=0.05)                                                                                                                                             | 6.7              | 0.25                               |

#### 4. Conclusion

The present study demonstrated that weed management practices significantly influenced grass and total weed control efficiency, plant height and seed yield per plant in *kharif* niger. Hand weeding at 20 and 40 DAS proved to be the most effective weed management practice, recording the highest grass and total weed control efficiency, plant height and seed yield per plant among the weed management treatments. Among the herbicide-based integrated weed management practices, pre-emergence application of pendimethalin + imazethapyr 2% EC @ 720 and 960 g a.i. ha<sup>-1</sup>, each followed by hand weeding at 30 DAS, effectively maintained higher grass and total weed control efficiency and produced plant height and seed yield per plant comparable with hand weeding at 20 and 40 DAS. Overall, pre-emergence application of pendimethalin + imazethapyr 2% EC @ 720 and 960 g a.i. ha<sup>-1</sup>, each followed by hand weeding at 30 DAS, proved to be the most effective herbicide-based integrated weed management practice for achieving higher weed control efficiency, plant height and seed yield per plant in *kharif* niger.

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