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## Weed indices and economics of bajra Napier hybrid as influenced by weed management practices

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### Abstract

An experiment was conducted to standardise an economic weed management strategy for Bajra Napier Hybrid in the variety of BN hybrid Suguna. The experiment was laid out in randomized block design (RBD) with 9 weed management treatments in three replications. Among the weed management practices, application of oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25 - 30 DAP (T<sub>5</sub>) recorded the lowest weed count, relative density, dry weight and the highest weed control efficiency at 25 and 50 DAP. The highest green fodder yield (154.84 t ha<sup>-1</sup>), dry fodder yield (30.96 t ha<sup>-1</sup>) and the lowest weed index was recorded in T<sub>5</sub>. The highest net returns of ₹ 123758.5 ha<sup>-1</sup> and significantly higher B:C ratio (1.66) was obtained in T<sub>5</sub> suggesting that the treatment T<sub>5</sub> (oxadiargyl@ 90 g ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25-30 DAP) could be adjudged as the economic weed management practice in Bajra Napier hybrid.

**Keywords:** BN hybrid, B:C ratio, net returns, weed control efficiency, weed index

### Introduction

Bajra Napier hybrid is a perennial, erect growing, nutritious, high yielding grass and suitable for cultivation under varying agro-climatic and soil conditions. The grass has gained considerable importance among livestock rearers because of its quick growth, better tillering and rejuvenating capacity. Hybrid Napier once planted supplies fodder continuously and regularly for a period of two to three years.

BN hybrid yield is essentially determined by weed competition that depends on the weed type, weed count, weed density, crop growth stage and weed infestation duration within the field. Weeds not only interfere with crop growth but also cause significant yield and quality losses. Gill (2016) [6]. Responding to the resources available, crop weed competition is the competition between crops and weeds. The identification of critical duration of weed competition is very necessary for efficacious weed management and to avoid damaging effects of weeds on yield and quality of crop. Weeding is a labour -intensive cultivation method. Setting a price on the research and development costs for herbicide use in crop production is extremely difficult. Many farmers soon adopted herbicide use and it became an important part of crop husbandry with some farmers still challenging the widespread use of chemicals in agriculture. Integration of chemical weed management with hand weeding as well as mechanical weeding has been reported as effective and economically viable method of weed management (Ram *et al.*, 2005) [11]. The potential role of chemical component in integrated management is well known in many crops whereas the information on selectivity of herbicides in BN hybrid is scanty. Keeping this in view, the present study is undertaken with the objective to standardise an economic weed management strategy for BN hybrid.

### Materials and Methods

The experiment was conducted during 2018-2020 at Instructional farm, College of Agriculture, Vellayani. The treatments were T<sub>1</sub>: oxadiargyl 60 g ha<sup>-1</sup> on 3-5 DAP *fb* carfentrazone ethyl 20 g ha<sup>-1</sup> on 25-30 DAP, T<sub>2</sub>: oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* carfentrazone ethyl 20 g ha<sup>-1</sup> on 25-30 DAP, T<sub>3</sub>: oxadiargyl 120 g ha<sup>-1</sup> on 3-5 DAP *fb* carfentrazone ethyl 20 g ha<sup>-1</sup> on 25-30 DAP, T<sub>4</sub>: oxadiargyl 60 g ha<sup>-1</sup> on 3-5 DAP *fb* hand

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Weeding on 25 - 30 DAP, T<sub>5</sub>: oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP fb hand weeding on 25 - 30 DAP, T<sub>6</sub>: oxadiargyl 120 g ha<sup>-1</sup> on 3-5 DAP fb hand weeding on 25 - 30 DAP, T<sub>7</sub>: biomulching, T<sub>8</sub>: farmers practice (hand weeding at 20 and 40 DAP) and T<sub>9</sub>: weedy check.

The field was made weed free initially and dry ploughed thrice manually. After leveling the field, 27 plots of size 3 m x 3 m were marked and beds were made. As a source of organic manure dried cow dung having N content of 0.45 per cent, P<sub>2</sub>O<sub>5</sub> content of 0.17 per cent and K<sub>2</sub>O content of 0.5 per cent was applied. For the experiment, source of NPK used were urea (46 per cent N), factamphos (20 per cent N and 20 per cent P<sub>2</sub>O<sub>5</sub>) and muriate of potash (60 per cent K<sub>2</sub>O). Three noddled cuttings were stuck into the soil at an angle to a depth with the basal end down so that the two nodes stayed within and one above the surface of the soil. A spacing of 60 cm x 60 cm was followed. The herbicides tested in the trial were oxadiargyl (80 WP) and carfentrazone ethyl (40% DF). Spraying of oxadiargyl @ 60, 90 and 120 g ha<sup>-1</sup> on 3-5 DAP and carfentrazone ethyl 20 g ha<sup>-1</sup> on 25-30 DAP was done using hand sprayer of spray volume 500 L ha<sup>-1</sup>.

Weed characters were studied at 25 and 50 DAP. Weed species predominant in the experimental field were found, classified and grouped as grassy weeds, broadleaved weeds (BLW) and sedges. Weed count at 25 and 50 DAP in each plot was recorded by using a quadrat (1 m x 1 m) in two random places. Grasses, sedge and BLW were recorded in each plot and expressed in number m<sup>-2</sup>. Relative density of group wise weeds were worked and expressed as percentage (Phillips, 1959)<sup>[9]</sup>.

$$\text{Relative density (\%)} = \frac{\text{Absolute density of a given species}}{\text{Total absolute density of all species}} \times 100$$

During each sampling point, weeds removed from each plot were air dried for one day and then dried to obtain a constant weight during 60 ° ± 5 ° C and expressed as g m<sup>-2</sup>. Weed Control Efficiency (WCE) was calculated with the method suggested by Mani and Gautham (1973)<sup>[7]</sup>

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

#### Where

WDC = Weed dry weight in the unweeded plot (g m<sup>-2</sup>)

WDT = Weed dry weight in the treated plot (g m<sup>-2</sup>)

The WI was calculated by the following formula (Gill and Vijay Kumar, 1969)<sup>[5]</sup>.

$$\text{WI(\%)} = \left( \frac{X - Y}{X} \right) \times 100$$

#### Where

X = Yield (kg ha<sup>-1</sup>) from minimum weed competition plot (maximum yield)

Y = Yield (kg ha<sup>-1</sup>) of treatment plot for which the weed index is to be worked out

The Bajra Napier hybrid grass was cut near the ground level in each plot and the fresh weight was recorded and green fodder yield was expressed as t ha<sup>-1</sup>. A weighted representative sample of green forage was obtained from each plot and was dried to constant weight in an oven at 70 ° C. Total DMY was calculated from the dry weight of the sample

and expressed as t ha<sup>-1</sup>. The crude protein content was calculated by multiplying the plant's nitrogen content by 6.25 (Simpson *et al.*, 1965)<sup>[13]</sup>. The crude fibre content was determined by AOAC method (AOAC, 1975)<sup>[11]</sup>.

Economics of cultivation was worked out based on the cost of cultivation and market price of the fodder crop.

The net returns and benefit: cost ratio were calculated as follows:

Net returns (₹ ha<sup>-1</sup>) = Gross income – Total expenditure

$$\text{Benefit: Cost ratio} = \frac{\text{Gross income}}{\text{Total expenditure}}$$

## Results and Discussions

### Weed Flora and Weed count

The predominant grassy weeds present in the experimental field were *Digitaria sanguinalis*, *Eleusine indica*, *Digitaria ciliaris*, *Dactyloctenium aegyptium*, broad leaf weeds were *Chenopodium album*, *Eclipta prostrata*, *Amaranthus viridis* and *Phyllanthus niruri* and the only one sedge present in the field was *Cyperus rotundus*. At 25 DAP sedges were predominant followed by broad leaved weeds and grass weeds. At 50 DAP, broad leaved weeds were predominant followed by grasses and sedges. Gill (2016)<sup>[6]</sup> observed the presence of grasses like *Acrachne racemosa*, *Dactyloctenium aegyptium*, *Eleusine indica*, broad leaved weeds like *Amaranthus viridis*, *Chenopodium album* and the sedge *Cyperus rotundus* in BN hybrid. With respect to total weed count, at 25 and 50 DAP the lowest total weed count, 1.68 and 1.27 respectively was observed in T<sub>5</sub> (oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP fb hand weeding on 25 - 30 DAP) and T<sub>9</sub> (weedy check) recorded the highest total weed count, 45.49 and 16.66 respectively). The reduction of weed count in T<sub>5</sub> (oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP fb hand weeding on 25 - 30 DAP) might be due to the effective control of weeds by the preemergence application of oxadiargyl along with the removal of weeds by hand weeding. Similar findings have been reported by Satao and Padole (1994)<sup>[12]</sup> and Charles (2013)<sup>[3]</sup>, Prabhu and Palsaniya (2016)<sup>[10]</sup> and Choudhary *et al.* (2017)<sup>[4]</sup>.

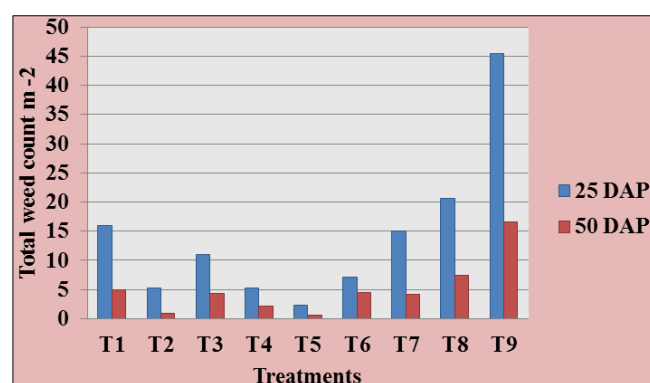


Fig 1: Weed count as influenced by weed management practice

### Weed relative density and weed dry weight

The relative density and dry weight of grassy weeds, broad leaved weeds and sedges was higher at 25 DAP and reduced thereafter). At 25 DAP, analogous to weed count, lower weed dry matter (0.54 g/m<sup>2</sup>) was observed in T<sub>5</sub> (oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP fb hand weeding on 25 - 30 DAP) and the treatment T<sub>9</sub> (weedy check) recorded significantly higher weed dry matter (16.81 g/m<sup>2</sup>) (Table 1). Similarly at 50 DAP, the lowest weed dry matter (0.25 g/m<sup>2</sup>) was observed in T<sub>5</sub>

(oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25 - 30 DAP) and significantly higher weed dry matter (12.11 g/m<sup>2</sup>) was observed in T<sub>9</sub> (weedy check). The weed dry weight in almost all treatments corresponded to the weed count that was recorded therein. Similar findings were reported by Singh *et al.* (2011)<sup>[14]</sup> and Prabhu and Palsaniya (2016)<sup>[10]</sup>.

### Weed Control Efficiency

At 25 and 50 DAP, the highest weed control efficiency (Table 1) was recorded in T<sub>5</sub> (oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25 - 30 DAP) which was on par with T<sub>2</sub> (oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* carfentrazonethyl 20 g ha<sup>-1</sup> on 25-30 DAP) and T<sub>4</sub> (oxadiargyl 60 g ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25 - 30 DAP). The higher weed control efficiency achieved in these treatments may be attributed to the substantial reduction of weed dry matter due to successful weed control by herbicide application or through the integration of chemical and cultural methods. Patel *et al.* (2000)<sup>[8]</sup> also reported that the integrated methods showed superiority over single methods. Similar results were recorded by Tiwari *et al.* (2011)<sup>[16]</sup> and Charles (2013)<sup>[3]</sup>.

**Table 1:** Effect of weed management practices on total weed dry matter and weed control efficiency

Treatments	Weed dry matter, g/m <sup>2</sup>		Weed control efficiency, %	
	25 DAP	50 DAP	25 DAP	50 DAP
T <sub>1</sub>	8.43	2.82	49.52 (7.44)	96.65 (8.70)
T <sub>2</sub>	1.22	0.35	92.46 (8.99)	96.82 (9.54)
T <sub>3</sub>	6.13	1.04	63.27 (7.74)	76.55 (7.94)
T <sub>4</sub>	1.67	0.39	89.96 (9.48)	96.38 (9.47)
T <sub>5</sub>	0.54	0.26	96.72 (9.61)	98.19 (9.90)
T <sub>6</sub>	3.25	0.42	80.98 (7.94)	90.18 (8.59)
T <sub>7</sub>	7.49	2.82	55.77 (7.06)	75.96 (7.27)
T <sub>8</sub>	12.45	3.17	25.10 (4.69)	74.03 (7.89)
T <sub>9</sub>	16.81	12.11	0 (0)	0 (0)
SEm (±)	0.24	0.12	0.46	0.16
CD (0.05)	0.46	0.24	1.40	0.48

Figures in parenthesis denote transformed values

### Weed Index

The treatment T<sub>5</sub> (oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25 - 30 DAP) which recorded the lowest total weed dry weight and the highest yield was taken as the best treatment for calculating weed index. During first, second and third harvest the treatment T<sub>5</sub> recorded zero weed index and it was significantly superior over other treatments. Weedy check recorded a weed index of 49.39, 46.87 and 45.01 per cent respectively, during first, second and third harvest. An increase of 47.14 per cent green fodder yield and 47.15 per cent dry fodder yield was recorded in the treatment T<sub>5</sub> (oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25 - 30 DAP) over T<sub>9</sub> (weedy check).

### Yield and quality attributes

The treatment T<sub>5</sub> (oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25 - 30 DAP) recorded significantly higher green fodder yield of 54.09, 50.12 and 50.62 t ha<sup>-1</sup>, respectively during the first, second and third harvest and the treatment T<sub>5</sub> was followed by T<sub>2</sub> (oxadiargyl 120 g ha<sup>-1</sup> on 3-5 DAP *fb* carfentrazonethyl 20 g ha<sup>-1</sup> on 25-30 DAP- 45.09 t ha<sup>-1</sup>). The treatment T<sub>9</sub> (weedy check) recorded the lowest green fodder yield of 27.34, 26.64 and 27.85 t ha<sup>-1</sup>, respectively at all the three harvests. Results on dry fodder yield followed the same trend of green fodder yield. The treatment T<sub>5</sub> (oxadiargyl 90 g

ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25 - 30 DAP) recorded significantly higher dry fodder yield of 10.81, 10.02 and 10.12 t ha<sup>-1</sup>, respectively during first, second and third harvests and was significantly superior to other treatments. Weedy check (T<sub>9</sub>) recorded the lowest dry fodder yields of 5.46, 5.82 and 5.57 t ha<sup>-1</sup>, respectively during first, second and third harvests.

**Table 2:** Effect of weed management practices on total green and dry fodder yield, t ha<sup>-1</sup>

Treatments	Total green Fodder yield	Total dry Fodder Yield
T <sub>1</sub>	114.63	22.92
T <sub>2</sub>	138.68	27.73
T <sub>3</sub>	124.29	24.85
T <sub>4</sub>	125.18	25.03
T <sub>5</sub>	154.84	30.96
T <sub>6</sub>	120.84	24.16
T <sub>7</sub>	114.58	22.91
T <sub>8</sub>	97.27	19.45
T <sub>9</sub>	81.84	16.36
SE	2.58	0.51
CD	7.81	1.56

The highest crude protein content (9.70%) was recorded in T<sub>2</sub> (Oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* Carfentrazonethyl 20 g ha<sup>-1</sup> on 25-30 DAP) which was on par with T<sub>5</sub> (Oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* Hand weeding on 25 - 30 DAP -9.40%) and the lowest crude protein was recorded in T<sub>9</sub> (weedy check - 8.14%). The lowest crude fibre content was recorded in T<sub>2</sub> (Oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* Carfentrazonethyl 20 g ha<sup>-1</sup> on 25-30 DAP-35.2%) which was on par with T<sub>5</sub> (Oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* Hand weeding on 25 - 30 DAP- 36.03%). The highest crude fibre content (38.11%) was recorded in T<sub>9</sub> (weedy check).

### Economics of cultivation

The total cost of cultivation was higher in T<sub>3</sub> (oxadiargyl 120 g ha<sup>-1</sup> on 3-5 DAP *fb* carfentrazonethyl 20 g ha<sup>-1</sup> on 25-30 DAP) mainly because of the higher dose and cost of the herbicides used. The lowest cost of cultivation was observed in T<sub>7</sub> (bio mulching), T<sub>8</sub> (farmers practice - hand weeding at 20 and 40 DAP) and T<sub>9</sub> (weedy check) since in there was no additional cost due to treatments.

Among weed control treatments, T<sub>5</sub> (oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25 - 30 DAP) recorded highest gross returns and the lowest was reported in T<sub>9</sub> (weedy check). This might be due to the effect of treatment which decreased weed crop competition resulting into highest fodder yield. Choudary *et al.* (2017)<sup>[4]</sup> also reported similar findings. Also highest net returns was obtained in T<sub>5</sub> (Oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* Hand weeding on 25 - 30 DAP) and lowest in T<sub>9</sub> (weedy check). Net returns are the basis for adoption of any new technology.

Weed management practices had significant effect on the B:C ratio. Significantly higher B:C ratio (1.66) was obtained in T<sub>5</sub> (oxadiargyl 90 g ha<sup>-1</sup> on 3-5 DAP *fb* hand weeding on 25 - 30 DAP) due to the highest fodder yield which ultimately resulted in the highest net returns. Similar findings were reported by Sharma and Singh (2010). Significantly lower B:C ratio (0.88) was obtained in weedy check in which the net returns was lower due to the reduction in green fodder yield due to heavy weed infestation. Similar results were reported by Walia *et al.* (2007)<sup>[17]</sup>, Sunitha *et al.* (2010)<sup>[15]</sup> and Arvadiya *et al.* (2012)<sup>[2]</sup>.

**Table 3:** Economics of cultivation of hybrid napier

Treatments	Cost of cultivation excluding treatments (Rs. ha <sup>-1</sup> )	Additional cost due to treatments (Rs. ha <sup>-1</sup> )	Total cost of cultivation (Rs. ha <sup>-1</sup> )	Gross returns (Rs. ha <sup>-1</sup> )	Net returns (Rs. ha <sup>-1</sup> )	Benefit: Cost ratio
T <sub>1</sub>	184769	1013	185782	229275.00	43493.00	1.23
T <sub>2</sub>	184769	1400	186169	277375.00	91206.00	1.48
T <sub>3</sub>	184769	1786	186555	248593.80	62038.77	1.33
T <sub>4</sub>	184769	773	185542	250375.00	64833.00	1.34
T <sub>5</sub>	184769	1160	185929	309687.50	123758.50	1.66
T <sub>6</sub>	184769	1546	186315	241683.40	55368.40	1.29
T <sub>7</sub>	184769	0	184769	229178.80	44409.80	1.24
T <sub>8</sub>	184769	0	184769	194541.70	9772.66	1.05
T <sub>9</sub>	184769	0	184769	163683.80	-21085.2	0.88

Price of 1 kg green fodder = Rs. 2.00, Price of 22.5g Oxadiargyl =Rs.290, Price of 25g Carfentrazone ethyl=Rs.300

### Conclusion

Considering the weed control efficiency, weed index, net returns and B: C ratio, treatment oxadiargyl@ 90 g ha<sup>-1</sup> on 3-5 DAP/hand weeding on 25-30 DAP could be adjudged as the economic weed management practice in Bajra Napier hybrid.

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