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Yield and nutrient uptake of Bajra Napier Hybrid as influenced by weed management practices

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Abstract
Present study was carried out during 2019-20, at College of Agriculture, Vellayani, Thiruvananthapuram, Kerala with an objective to standardise an economic weed management strategy for Bajra Napier Hybrid. The experiment was laid out in randomized block design (RBD) with 9 treatments in three replications. The variety used for the study was Suguna, released from Kerala Agricultural University. Analysis of data showed that weed management practices had significant effect on yield and nutrient uptake of BN hybrid. The treatment oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP recorded the highest green fodder yield and dry fodder yield. An increase of about 47.14 % in green fodder yield was recorded in oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP over weedy check. Significantly higher nitrogen, phosphorus and potassium uptake were observed with the application of oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP.

Keywords: Bajra Napier Hybrid, dry fodder yield, green fodder yield, nutrient uptake

Introduction
The livestock is the sub-sector of agriculture sector which adds almost 32 per cent of Agriculture output in India. India assists 20 per cent of the livestock population of the world covering 2.3 per cent geographical area (Datta, 2013) [4]. Kerala ranks 14 among the milk producing states in India with a share of just 1.5 per cent of the total milk production in the country (GOK, 2017) [7]. Majority of livestock farmers in Kerala are either small and marginal or even landless. Fodder crops are cultivated in 7,000 ha which produces green fodder to meet only about 2 percent of the total dry fodder requirement of the state. fodder production per unit area should be increased by growing high yielding multi cut forage crops such as guinea grass and Bajra Napier hybrid. 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.
The yield of BN hybrid is determined by the extend of weed competition that depends mainly on the weed indices and stage of crop growth and duration of infestation in the field. The greatest losses in the Bajra Napier hybrid are experienced when the weeds are not checked, particularly during critical crop weed competition period. The higher the density of weeds, the shorter the time that crops can tolerate competition from weeds (Dillehay *et al.*, 2011) [5].
Innovation in bio-farming demanded a non-chemical approach to weed control**.** The public's environmental consciousness and interest in organic food production, has led to a number of non chemical weed control methods being used. 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) [9]. The information on the potential role of chemical component in integrated weed management 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 laid out in the Instructional Farm attached to the College of Agriculture, Vellayani, Thiruvananthapuram, Kerala during 2019-20. The treatments were oxadiargyl 60 g ha^{-1} on 3-5 DAP *fb* carfentrazone ethyl 20 g ha^{-1} on 25-30 DAP, oxadiargyl 90 g ha^{-1}on 3-5 DAP *fb* carfentrazone ethyl 20 g ha^{-1}on 25-30 DAP, oxadiargyl 120 g ha^{-1} on 3-5 DAP *fb* carfentrazone ethyl 20 g ha^{-1} on 25-30 DAP, oxadiargyl 60 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP, oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP,

oxadiargyl 120 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP, biomulching, farmers practice (hand weeding at 20 and 40 DAP) and weedy check.

Bajra Napier hybrid variety Suguna, released from AICRP in Forage Crops and Utilization, Vellayani, Kerala Agricultural University was selected for this study. Three month old stem cutting with three nodes were stuck into the soil at a spacing of 60 cm x 60 cm. The first harvest was taken 75 DAP and subsequent harvests at an interval of 45 days. A hand sprayer was used to spray herbicides at a spray volume of 500 L ha^{-1}. Weed characters (weed count, relative density, dry weight, weed control efficiency) were studied at 25 and 50 DAP. Weed count at 25 DAP and 50 DAP in each plot was recorded by using quadrat (1 m x 1 m) in two places at random and expressed as number per square meter and the relative density of group wise weeds were worked out. The Bajra Napier hybrid grass in each plot was cut close to the ground level and the fresh weight was recorded and yield of green fodder expressed as t ha^{-1}. A weighed representative sample of green forage was collected from each treatment and was dried in an oven at 70°C to constant weight. From the dry weight of sample, total dry matter yield was calculated and expressed as t ha $^{-1}$.

WI was calculated according to the following formula:

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

Where, X denotes yield (kg ha^{-1}) from minimum weed competition plot (maximum yield) and Y denotes yield (kg ha^{-1}) (Gill and Vijay Kumar, 1969) [6].

At harvest, samples were gathered, then chopped, shaded, and oven dried (70°C) to a constant weight. Samples were grounded to pass through a 0.5 mm mesh in a Willey Mill. The required sample quantities were digested and used to analyze the nutrients.The nitrogen content in plant was estimated by modified micro kjeldhal method (Jackson, 1973). The uptake of N by the fodder crop during crop growth period was calculated as the product of the content of the nutrient in plants and the dry weight of plants and expressed as kg ha^{-1}. The phosphorus content in the plant was estimated calorimetrically by Vanado – molybdate yellow colour method using spectrophotometer (Jackson, 1973). The uptake of phosphorus was determined by multiplying the phosphorous content with dry plant weight. The values are in kg ha^{-1}. The potassium content in the plant samples was determined by the flame photometric method (Jackson, 1973). The uptake of potassium was calculated by multiplying the K content with the dry weight of plants and expressed in kg ha^{-1}.

Results and Discussion

Weed count

At 25 DAP, the highest total weed count of 45.49 no. m^{-2} was recorded under weedy check and the lowest total weed count of 2.32 no. m^{-2} was observed in oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP. At 50 DAP the highest total weed count (16.66 no. m^{-2}) was observed under weedy check and the lowest (0.66 no. m^{-2}) was observed in oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP. This reduction of weed count might be due to the effective control of weeds by the pre emergence application of oxadiargyl along with the removal of weeds by hand weeding. Similar findings have been reported by Charles (2013) [2], Prabhu and Palsaniya (2016) [8] and Choudhary *et al.* (2017) [3].

Weed density and dry weight

The weed management treatments significantly influenced the relative density and dry weight of weeds. It was observed that 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 and 50 DAP, analogous to weed count, lower weed dry matter was observed in oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP and the weedy check recorded significantly higher weed dry matter. This reduction in weed count, relative density and weed dry weight might be due to the favourable effect of the weed control treatments and also due to the increase in growth.

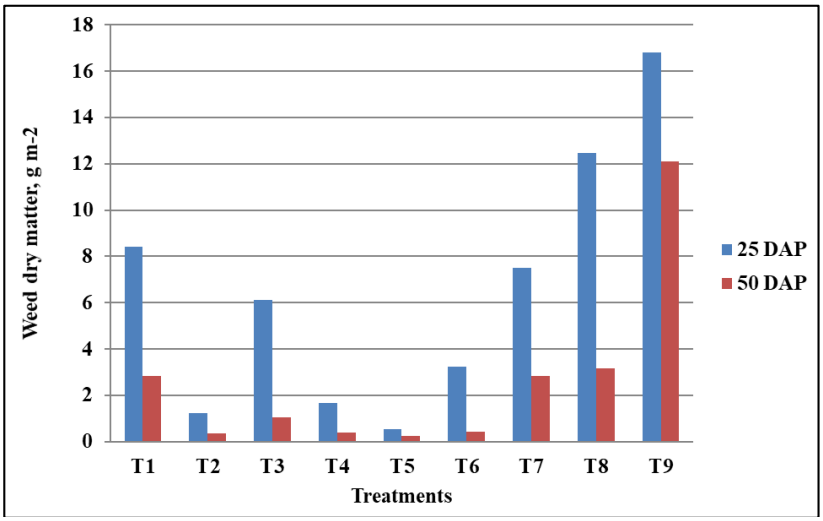

Fig 1: Effect of weed management practices on total weed dry matter

Weed control efficiency

The highest weed control efficiency was recorded under oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP which was on par with oxadiargyl 90 g ha^{-1}on 3-5 DAP *fb* carfentrazone ethyl 20 g ha^{-1}on 25-30 DAP and oxadiargyl 60 g ha^{-1} 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. Similar results were recorded by Tiwari *et al.* (2011) [11].

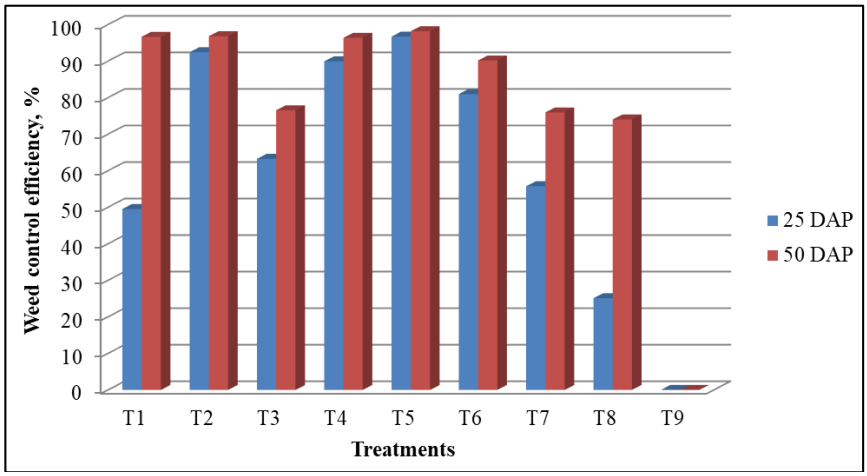

Fig 2: Effect of weed management practices on weed control efficiency

Green Fodder Yield

The treatment with oxadiargyl 90 g ha^{-1} 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^{-1}, respectively during the first, second and third harvest and the treatment with oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP was followed by oxadiargyl 120 g ha^{-1} on 3-5 DAP *fb* carfentrazone ethyl 20 g ha^{-1} on 25-30 DAP- 45.09 t ha^{-1}. The weedy check recorded the lowest green fodder yield of 27.34, 26.64 and 27.85 t ha^{-1}, respectively at all the three harvests.

The total green fodder yield also followed the same trend as that of green fodder yield at each harvest. The treatment with application of oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP recorded the highest total green fodder yield (154.84 t ha^{-1}) and the weedy check recorded the lowest total green fodder yield (81.84 t ha^{-1}).

Dry Fodder Yield

Results on dry fodder yield followed the same trend of green fodder yield. The treatment with oxadiargyl 90 g ha-1 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^{-1}, respectively during first, second and third harvests and was significantly superior to other treatments. Weedy check recorded the lowest dry fodder yields of 5.46, 5.82 and 5.57 t ha^{-1}, respectively during first, second and third harvests.

Total dry fodder yield also followed the same trend of dry fodder yield of individual harvests. The highest total dry fodder yield was registered in oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP(30.96 t ha^{-1}) and the lowest total dry fodder yield was obtained in weedy check (16.36 t ha^{-1}).

Nutrient uptake

The results revealed that significantly higher N uptake (318.97 kg ha^{-1}), P uptake(27.87 kg ha^{-1}) and K uptake (356.14 kg ha^{-1}) was observed in oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP and lower N, P, K uptake was observed in weedy check (168.59, 14.73 and188.23 kg ha^{-1} respectively). The increased uptake of nutrients might be due to reduced crop weed competition for nutrients which resulted in improved root growth, high photosynthesis rate, better use of carbohydrates in the more protoplasm synthesis which ultimately resulted in increased plant growth and thus increased plant height, leaf area, number of tillers, leaf stem ratio and tussock diameter under this treatment over other treatments. Similar findings were reported by Sunitha *et al.* (2010) [10] and Arvadiya *et al.* (2012) [1]

Table 1: Effect of weed management practices on green and dry fodder yield at each harvest, t ha^{-1}

Treatments	Green fodder yield				Dry fodder yield			
	75 DAP (1st harvest)	120 DAP (2nd harvest)	165 DAP (3rd harvest)	Total	75 DAP (1st harvest)	120 DAP (2nd harvest)	165 DAP (3rd harvest)	Total
T_1	41.14	36.14	37.34	114.63	8.22	7.22	7.46	22.92
T_2	49.39	44.39	44.89	138.68	9.87	8.87	8.97	27.73
T_3	45.09	39.09	40.09	124.29	9.02	7.82	8.02	24.85
T_4	43.22	40.22	41.72	125.18	8.64	8.04	8.34	25.03
T_5	54.09	50.12	50.62	154.84	10.81	10.02	10.12	30.96
T_6	40.28	39.495	41.06	120.84	8.05	7.89	8.21	24.16
T_7	37.76	38.33	38.49	114.58	7.55	7.66	7.69	22.91
T_8	31.25	32.76	33.26	97.27	6.25	6.55	6.65	19.45
T_9	27.34	26.64	27.85	81.84	5.46	5.32	5.57	16.36
SEm (±)	1.40	0.90	0.79	2.58	0.28	0.18	0.16	0.51
CD (0.05)	4.25	2.73	2.41	7.81	0.85	0.54	0.48	1.56

Table 2: Effect of weed management practices on the uptake of nitrogen, phosphorus and potassium, kg ha^{-1}

Treatments	N Uptake	P Uptake	K Uptake
T_1. oxadiargyl 60 g ha^{-1} on 3-5 DAP *fb* carfentrazone ethyl 20 g ha^{-1} on 25-30 DAP	236.15	20.63	263.66
T_2. oxadiargyl 90 g ha^{-1}on 3-5 DAP *fb* carfentrazone ethyl 20 g ha^{-1}on 25-30 DAP	285.69	24.96	318.98
T_3. oxadiargyl 120 g ha^{-1} on 3-5 DAP *fb* carfentrazone ethyl 20 g ha^{-1} on 25-30 DAP	256.05	22.37	285.88
T_4. oxadiargyl 60 g ha^{-1} on 3-5 DAP f*b* hand weeding on 25 - 30 DAP	257.88	22.53	287.93
T_5. oxadiargyl 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP	318.97	27.87	356.14
T_6. oxadiargyl 120 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25 - 30 DAP	248.93	21.75	277.93
T_7. Biomulching	236.05	20.62	263.55
T_8. farmers practice (hand weeding at 20 and 40 DAP)	200.37	17.50	223.72
T_9. weedy check	168.59	14.73	188.23
SEm (±)	5.32	0.46	5.94
CD (0.05)	12.10	1.40	17.98

Conclusion

Considering the green fodder yield, dry fodder yield, weed control efficiency, weed index and nutrient uptake, application of oxadiargyl @ 90 g ha^{-1} on 3-5 DAP *fb* hand weeding on 25-30 DAP could be adjudged as the economic weed management practice in Bajra Napier hybrid.

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