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STUDIES ON INTEGRATED WEED MANAGEMENT IN BLACK GRAM (*VIGNA MUNGO* L.) UNDER RAIN FED CONDITION OF NAGALAND, INDIA

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ABSTRACT

The experiment was conducted in the research farm of SASRD, Nagaland University during the *kharif* period of 2016 to study about the efficiencies of integrated weed management in black gram (*Vigna mungo* L.) and was carried out based on randomized block design (RBD) with three replications followed by treatment of seven. From the trial, it summarized that under free weed treatment resulted the maximum yield and growth of black gram was observed (1109.55 kg ha^{-1}), lessening the weed dry matter build up and maximum weed density, hence maximum weed controlling efficiency (100%) while in terms of herbicidal treatments, pendimethalin (pre) treatment @ 1 kg ha^{-1}fb 1 HW at 25 DAS concluded to highest yield result (910.96 kg ha^{-1}), however, under treatment of quizalofop-ethyl@ 50 g ha^{-1} at 25 DAS concluded in the maximum B: C ratio (1.18) and concluding to be the best possible treatment for black gram in *kharif* season.

Keywords : Black gram, Economics, Pendimethalin, Quizalofop-ethyl @ 50 g and Weed free.

INTRODUCTION

Black gram (*Vigna mungo* L.) is an important leguminous crop, mainly known for its ability in fixing atmospheric nitrogenand also grown as a secondary mixed crop.India is the world's largest producer as well as consumer of black gram and accounts upto 13% total pulses area and 10% total pulses production in India (Anonymous, 2014). Among the various challenges faced by farmers, weeds is one of the major factor which compete for nutrient, water, light and space with crop plant and cause up to 45% yield loss in black gram (Yadav *et al.,* 1997). Black gram is not a very good competitor against weeds (Choudhary *et al.,* 2012) and the critical period of crop weed competition in black gram ranges from 15 to 45 days (Vats and Sawhney, 1980). Yield losses in black gram due to weeds have been estimated to range between 30-50% (Bhan and Singh 1991), hence,weed management is an important key factor for enhancing the productivity of summer black gram.Weed management is commomly done by hand weeding at 20 DAS followed by another weeding about 40 DAS. But manual hand weeding is labor intensive and tedious and does not ensure weed removal at critical stage of crop-weed competition. Moreover, continous rainfall during season makes the manual weeding impracticable (Shweta and Singh 2005). Though chemical herbicides become cost-effective, their efficacies are greatly reduced during kharif due to uncertain rainfall(Bhowmick and Gupta 2005). Application of single herbicide may not be affective in providing broad spectrum weed control, however, the application of pre (pendimethalin) and post emergence (quizalofop-ethyl and imazethapyr) herbicides either in combination or sequence, or integration with manual weeding may be more beneficial. Since blackgram is grown in small scale in Nagaland, weed control is mostly done by hand weeding. Even though hand weeding has advantages it also has negative impact as it is time consuming, laborious and italone cannot control weeds in large area. So, some herbicides should be recommended to the farmers with proper guidance which canbe integrated with cultural and physical methods to provide the best possible weed management strategies to limit the deleterious effects of weeds growing with crop plants is used.Even though all IWM may not be usefull for all weed species, its approach can greatly increase the effectiveness of human errors.Thus, in order to help the farmers to grow black gram in large scale and increase productivity, therefore, the following study was aimed to investigate on integrated weed management practice neededby the farmers to be adopted indetermining out the best management practice.

MATERIALS AND METHODS

A field experiment was conductedduring the *kharif* period of 2016 at the SASRD, Nagaland University where it was located at 25º45' 09.2" N latitude and 93º51' 18.6" E longitude with an altitude of 310 meter above mean sea level. The soil site was reported to be acidic in nature with pH of 4.62, high organic carbon (1.68 %), medium available N

(388.86 kg ha^{-1}), low available P_2O_5 (14.20 kg ha^{-1}), high available K_2O (349.70 kg ha^{-1}) respectively and followed Randomized Block Design (RBD) with three replications and seven treatments. The treatments consisted of: W_1-Weed free; W_2-Weedy check; W_3-Pendimethalin (pre-em) @ lkg ha^{-1} ; W_4-Pendimethalin (pre-em) @ 1 kg ha^{-1}*fb* 1 HW at 25 DAS; W_5- Quizalofop-ethyl @ 50g ha^{-1} at 25 DAS; W_6- Stale Seed Bed Technique *fb* 1 HW at 25 DAS and W_7-Pendimethalin @ 1 kg ha^{-1} (pre) + Quizalofop-ethyl @ 50g ha^{-1}at 25 DAS. The experimental site was ploughed with tractor drawn disc harrow in the first week of August followed by harrowing with tractor drawn rotavator, then after removing the stubbles and weeds, the experimental plan and design was carried out. The recommended NPK fertilizers was applied at the rate of 20 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} in the form of urea, SSP and MOP respectively. Seeds were sown in furrows in lines with a spacing of 40cm x 10 cm at a depth of 5 cm with seed rate 15 kg ha^{-1}. Hand weeding was carried out with the help of khurpi and local hand hoe. Herbicides were sprayed using a knap sack sprayer with flood jet deflector nozzle size WFN 0.040 ensuring uniform spraying. Weeds population was counted individually at 20 DAS, 40 DAS and at harvest of each plot from inside an area of 0.5m x 0.5 m and expressed as count m^{-2}. The data was then converted to number per square meter. Oven dry weight of weeds was recorded after sundried and oven dried at 60^0 C for 24 hours and converted to gm^{-2}.Both the data, weed population and dry weights were then transformed using square root transformation prior to statistical analysis for test of significance. Weed Control Efficiency (WCE) was calculated by the formula,

$$WCE = \frac{WC - WT}{WC} X100$$

Where, W_c= Dry weight of weeds per unit area in the unweeded control plot

W_t= Dry weight of weeds per unit area in the plot under treatment

The plant growth attributes were recorded at 20, 40 DAS and at harvest except number of nodules per plant and LAI at 30 and 45 DAS, while CGR and RGR at30-45 DAS and 45-60 DAS and the yield attributes at harvest. Among the growth attributes, LAI, CGR and RGR were determined by the following formulae,

$$LAI = \frac{Total\ leaf\ area\ (m^2)}{Area\ of\ land\ (m^2)}$$

$$CGR = \frac{W_2 - W_1}{A(t_2 - t_1)}$$

Where, W_1 and W_2 are plant dry weight (g) at time t_1 and t_2 respectively.

A= Land area (m^{-2})

$$*RGR = \frac{\log_e W_2 - \log_e W_1}{t_2 - t_1}$$

Where, w_1 and w_2 are plant dry weight (g) at time t_1 and t_2 respectively.

RESULTS AND DISCUSSION

Effect on weeds: The weed species found in the experimental site were *Mimosa spinosus* (L.), *Ludwiga linifolia, Melochia corchorrifolia*, *Euphorbia hirta*, *Borerria hispida* and *Ageratum conyzoides*as broad leaf weeds; *Digitaria sanguinalis* (L.), *Cynodon dactylon* (L.), *Eleusine indica* (L.) and *Echinochloa colona* grasses; *Cyperus rotundus* (L.) as sedges. The study revealed that weed free reduces weed density, weed dry matter accumulation and hence, maximum weed control efficiency (100 %) and in herbicidal treatments, pendimethalin (pre) @ 1 kg ha^{-1}*fb* 1 HW at 25 DAS produced the highest yield (910.96 kg ha^{-1}). The maximum weed population and dry matter accumulation was found in weedy check treatment in all the stages of observation at 20 DAS, 40 DAS and at harvest for all the categories of weed species while lowest weed population and dry matter accumulation of broad leaf weeds was found in weed free at 25 DAS and among the herbicidal treatment, lowest weed dry matter accumulation was reported in pendimethalin (pre) @ 1 kg ha^{-1}*fb* 1 HW at 25 DAS at harvest. The remarkable reduction in weed population at different stages might be due to effective weed control in respective treatments either manual or herbicidal control or both, these findings were similar with Chaudhari *et al*. (2016) who also reported that the lowest weed population of monocot was recorded in weed free and among the herbicide in pendimethalin (pre) @ 1 kg ha^{-1}*fb* 1 HW at 25 DAS. Excellent performance of pendimethalin (pre) + one hand weeding might be due to initial control of broad leaf weeds which prevented further emergence of weeds leading to lowest weed dry matter accumulation, similar findings were found in Khot*et al.* (2012).

At the time of harvest, the lowest sedges population and dry matter accumulation was recorded in weed free treatment (0.71 g m^{-2}) and among the herbicidal treatment it was observed in pendimethalin (pre) @ 1 kg ha^{-1}*fb* 1 HW at 25 DAS and was at par with Stale Seed Bed Technique *fb* 1 HW at 25 DAS in case of dry weight. This may be because of more significant decrease of weed seeds germination by use of pre-emergence herbicide that gave lesser weed pressure at initial stage and followed by the elimination of weeds by hand weeding causing huge decrease in late emerged weeds accounting lesser density and dry weight, this confirms the report of Sanbagavalli *et al*. (2016).

It was observed that weed free recorded the least density and dry matter accumulation of grasses and among the herbicidal treatment it was observed in pendimethalin (pre) @ of 1kg ha^{-1}*fb* 1 HW at 25 DAS at harvest. The reduction in weed density may be due to the application of pendimethalin as pre- emergence herbicides, as this herbicide hampers the emergence and growth of weed seedlings due to reduction in cell elongation and division, similarly was recorded by Bhowmick *et al*. (2015). This might also be due to effective weed control obtained under, hand weeding and pre-emergence application herbicides at initial stage which resulted into the lowest weed counts, reducing the total dry weight of weeds at harvest, and ultimately leading to the rapid growth of crop, increasing the crop canopy which suppressed the growth of weeds, similar were reported by Chaudhari *et al*. (2016) and Das *et al*. (2014).

Among the weed control treatments weed free showed weed control efficiency of 100 percent in and weedy check has the lowest weed control efficiency. It has been observed that in herbicidal treatment weed control efficiency was highest in pendimethalin (pre) @ 1kg ha^{-1}*fb* 1 might be due to application of herbicide under pre-emergence with manual

wedding during the early stages of weed germination HW at 25 DAS (76.5) and Stale Seed Bed Technique *fb* 1 HW at 25 DAS (63.5) at harvest. Broad leaved weeds along with sedges permit less accumulation for dry matter which accounts for more and finer yield, thus suppressing the weed population as compared to the others and resulting to highest weed controlling ability, similar with results of Adpawar *et al*. (2011) and Chaudhari *et al*. (2016).

Effect on plant

The maximum plant height was recorded with pendimethalin @ 1 kg ha^{-1} pre-emergence + quizalofop-ethyl @ 50 gha^{-1} at 25 DAS and it was at par with weed free at harvest. This was due to least competition from weeds for the space and light, as well as above and below ground resources (Kumar *et al.,* 2015). The number of branches plant^{-1} increased with crop age and thus maximized at harvest stage under all treatments, while the no. of primary branches were maximum in weed free and lowest in weedy check. At the time of harvest, the highest number of branches was recorded in pendimethalin @ 1 kg ha^{-1} (pre) + quizalofop-ethyl @ 50 gha^{-1} at 25 DAS. This might be due to lesser crop weed competition in these treatments because of effective weed control, similar to Kumar *et al*. (2015) and Balyan *et al*. (2016). Among the several herbicidal treatments, highest dry matter accumulation was recorded in pendimethalin (pre) @ 1kg ha^{-1}*fb* 1 HW at 25 DAS and the lowest in weedy check (0.55, 1.72 and 5.17) for 30, 45 and 60 DAS. The weed free treatment reduced the crop weeds competition by providing no weed situation in black gram field. Thus, the crop being vigorous by efficiently utilization of nutrients, moisture, and sunlight with space gave better yield leading to highest dry weight of plants(Naidu *et al*. 2012). The highest root nodules plant^{-1} were recorded in weed free treatment and pendimethalin (pre) @ 1kg ha^{-1}*fb* 1 HW at 25 DAS and was found at par with pendimethalin @ 1kg ha^{-1} (pre) + quizalofop-ethyl @ 50 gha^{-1} at 25 DAS, Quizalofop-ethyl @ 50g ha-1 at 25 DAS and pendimethalin @ 1kg ha^{-1} pre-emergence at 30 and 45 DAS respectively. Better growth attributes caused more accumulation and translocation of photosynthates by the crop, which resulted to more number and dry weight of nodules (Choudhary *et al*., 2012).

The highest pod length, number of pods plant^{-1}, no. of seeds pod^{-1}, test weight, seed yield ha^{-1}, stover yield and harvest index was recorded in weed free treatment and the lowest in weedy check, while the highest pod length was recorded in pendimethalin (pre) @ 1kg ha^{-1}*fb* 1 HW at 25 DAS and was at par with stale seed bed technique *fb* 1 HW at 25 DAS, quizalofop-ethyl @ 50 gha^{-1} at 25 DAS and pendimethalin @ 1kg ha^{-1} (pre) + quizalofop-ethyl @ 50 gha^{-1} at 25 DAS, Balyan*et al*. (2016) also reported such similar reults. The highest number of pods plant^{-1} recorded in pendimethalin (pre) @ 1kg ha^{-1}*fb* 1 HW at 25 DAS and was at par with stale seed bed technique *fb* 1 HW at 25 DAS, similar was reported by Kavad*et al*. (2016); while the highest no. of seeds pod^{-1} was observed in pendimethalin (pre) @ 1kg ha^{-1}*fb* 1 HW at 25 DASand was at par with stale seed bed technique *fb* 1 HW at 25 DAS, quizalofop-ethyl @ 50 gha^{-1} at 25 DAS and pendimethalin @ 1kg ha^{-1} (pre) + quizalofop-ethyl @ 60ml ha^{-1} at 25 DAS. Bhowmick *et al*. (2015) reported that pendimethalin (pre) @ 1kg ha^{-1}*fb* 1 HW at 25 DAS gave the highest no of seeds pod^{-1}. pendimethalin (pre) @ 1 kg ha^{-1}*fb* 1 HW at 25 DAS gave the highest test weight and was at par with all the other treatments (Kavad *et al*. 2016). Maximum yield was recorded in pendimethalin (pre) @ 1 kg ha^{-1}*fb* 1 HW at 25 DAS followed by stale seed bed technique *fb* 1 HW at 25 DAS and quizalofop-ethyl @ 50 gha^{-1} at 25 DAS. A uniform plant population per unit area increased the number of leaves resulting in higher photosynthesis assimilation rates in metabolic activity and cell division which consequently increased the growth characters and yield attributes which was maintained due to application of herbicides. This resulted in lower nutrient depletion and lesser dry weight of weeds and thereby increasing the nutrient uptake of crop growth and yield attributes and seed yield of black gram. These were in accordance with the earlier findings of Hemraj *et al*. (2009) and Naidu *et al.* (2011). The maximum stover yield was recorded in pendimethalin (pre) @ 1 kg ha^{-1}*fb* 1 HW at 25 DAS, Kavad *et al.* (2016) also reported similar results.

The maximum root nodules plant^{-1} and LAI was recorded in weed free treatment and lowest in weedy check in all stages of observation. Pendimethalin (pre) @ 1kg ha^{-1}*fb* 1 HW at 25 DAS recorded the highest among the herbicidal treatment and was found at par with pendimethalin @ 1kg ha^{-1} (pre) + quizalofop-ethyl @ 50 gha^{-1} at 25 DAS, Quizalofop-ethyl @ 50g ha^{-1} at 25 DAS and pendimethalin @ 1kg ha^{-1} pre-emergence at 30 and 45 DAS respectively. Better growth attributes caused more accumulation and translocation of photosynthates by the crop, which resulted in more number and dry weight of nodules (Choudhary *et al*., 2012). The herbicidal treatment pendimethalin (pre) @ 1kg ha^{-1} *fb* 1 HW at 25 DAS recorded the highest LAI at 30 and 45 DAS which was at par with weed free and pendimethalin @ 1kg ha^{-1} pre-emergence, similar findings were also concluded by Sahoo (2014).

The highest CGR and RGR data was observed in weed free and lowest in weedy check in all stages of observation. Among the herbicidal treatments, pendimethalin (pre) @ 1kg ha^{-1}*fb* 1 HW at 25 DAS recorded the highest CGR and RGR in 30-45 and 45-60 DAS. The enhancement in crop growth component could be due to less competition by weeds throughout the crop growth period because of removal of weeds before establishment, it is evident with Kathiresan (2002) and Chhodavadia *et al*. (2014). Maximum gross return (55,477.5 ha^{-1}) was recorded with weed free and lowest was recorded in weedy check, while net return (27, 201.05 ha^{-1}) was observed in weed free and the lowest in weedy check. However, the highest benefit cost ratio (1.18) was recorded with quizalofop-ethyl @ 50g ha^{-1}at 25 DAS and lowest with weedy check, similar with Rao (2011) and Patel *et al*. (2014)

CONCLUSION

From the above findings it can be concluded that herbicidal treatments, pendimethalin (pre) @ 1 kg ha^{-1} *fb* 1 HW at 25 DAS produced the maximum yield (910.96 kg ha^{-1}) of blackgram, thereby resulting in effective control of weeds recording the highest weed control efficiency. However, from economic point of view, application of Quizalofop-ethyl @ 50 g ha^{-1} at 25 DAS gave the highest B: C ratio (1.18) and concluded to be economically and best feasible treatment for *kharif* black gram.

Table 1: Effect of different weed management practices on weed at 40 DAS .

Treatment	Weed population (No. of weeds m^{-2})			Weed dry matter accumulation (g m^{-2})			Weed control efficiency (%)
	Broad leaf weeds	Sedges	Grasses	Broad leaf weeds	Sedges	Grasses	
W_1 – Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	100
W_2- Weedy check	6.68 (44.33)	4.70 (21.67)	10.24 (104.33)	4.10 (16.33)	2.24 (5.00)	4.99 (24.83)	0
W_3 – Pendimethalin @ 1 kg ha^{-1} pre-emergence	5.15 (26.33)	1.64 (2.67)	5.99 (36.33)	2.59 (6.37)	1.04 (0.63)	3.32 (11.20)	56.7
W_4 – Pendimethalin (pre) @ 1 kg ha^{-1} *fb* 1 HW at 25 DAS	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	100
W_5 – Quizalofop-ethyl @ 50 gethyl @ 50g ha-1 at 25 DAS	5.70 (32.67)	1.68 (2.33)	4.83 (24.33)	2.96 (8.33)	1.25 (1.07)	2.97 (8.70)	57.7
W_6 – Stale Seed Bed Technique *fb* 1 HW at 25 DAS	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	100
W_7 - Pendimethalin @ 1 kg ha^{-1} (pre) + Quizalofop-ethyl @ 50 gethyl @ 60 ml ha^{-1}at 25 DAS	4.93 (17.33)	1.47 (2.00)	5.16 (26.33)	2.26 (5.00)	1.41 (1.73)	2.48 (5.83)	72.2
SEm±	0.28	0.24	0.44	0.21	0.16	0.33	5.6
CD (P=0.05)	0.84	0.72	1.31	0.64	0.49	0.98	20.3

Table 2: Effect of different weed management practices on weed at harvest

Treatment	Weed population (No. of weeds m^{-2})			Weed dry matter accumulation (g m^{-2})			Weed control efficiency (%)
	Broad leaf weeds	Sedges	Grasses	Broad leaf weeds	Sedges	Grasses	
W_1 – Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	100
W_2- Weedy check	6.40 (104.67)	6.68 (44.3)	10.36 (107.00)	3.76 (13.80)	1.56 (1.92)	4.25 (17.67)	0
W_3 – Pendimethalin @ 1 kg ha^{-1} pre-emergence	4.25 (40.67)	1.56 (2.00)	5.92 (34.67)	2.67 (6.67)	0.99 (0.49)	3.74 (13.93)	36.9
W_4 – Pendimethalin (pre) @ 1 kg ha^{-1} *fb* 1 HW at 25 DAS	6.59 (17.67)	1.00 (0.67)	3.68 (15.00)	2.00 (3.50)	0.77 (0.11)	2.13 (4.12)	76.5
W_5 – Quizalofop-ethyl @ 50 gethyl @ 50g ha-1 at 25 DAS	4.32 (43.00)	1.76 (2.67)	5.97 (36.00)	3.24 (10.13)	1.07 (0.65)	3.82 (14.13)	24.5
W_6 – Stale Seed Bed Technique *fb* 1 HW at 25 DAS	6.24 (18.67)	1.17 (1.00)	4.64 (21.33)	2.28 (4.73)	0.84 (0.24)	2.76 (7.33)	63.5
W_7 - Pendimethalin @ 1 kg ha^{-1} (pre) + Quizalofop-ethyl @ 50 gethyl @ 60 ml ha^{-1}at 25 DAS	6.24 (39.33)	1.68 (2.33)	5.87 (34.00)	3.13 (9.40)	1.15 (0.84)	2.84 (8.15)	43.2
SEm±	0.37	0.22	0.45	0.19	0.08	0.28	6.9
CD (P=0.05)	1.10	0.66	1.36	0.57	0.23	0.84	25.2

Table 3: Effect of different weed management practices on crop

Treatment	Root nodules $plant^{-1}$		LAI		CGR (g m^{-2} day^{-1})		RGR (g g^{-1} day^{-1})	
	30 DAS	45 DAS	30 DAS	45 DAS	30-45DAS	45-60 DAS	30-45DAS	45-60 DAS
W_1 – Weed free	41.00	58.53	0.67	1.11	4.50	9.23	0.044	0.027
W_2- Weedy check	28.10	37.97	0.51	0.75	1.98	5.74	0.032	0.019
W_3 – Pendimethalin @ 1 kg ha^{-1} pre-emergence	33.67	49.83	0.60	1.03	2.73	6.87	0.037	0.024
W_4 – Pendimethalin (pre) @ 1 kg ha^{-1} *fb* 1 HW at 25 DAS	40.10	58.07	0.61	1.09	3.38	7.70	0.041	0.025
W_5 – Quizalofop-ethyl @ 50 gethyl @ 50g ha^{-1} at 25 DAS	38.33	52.07	0.58	1.01	3.11	6.73	0.036	0.023
W_6 – Stale Seed Bed Technique *fb* 1 HW at 25 DAS	30.00	48.63	0.59	0.98	2.70	7.15	0.037	0.024
W_7 - Pendimethalin @ 1 kg ha^{-1} (pre) + Quizalofop-ethyl @ 50 gethyl @ 60 ml ha^{-1}at 25 DAS	38.67	50.50	0.58	0.91	2.46	6.92	0.036	0.023
SEm±	2.39	2.95	0.02	0.03	0.44	0.59	0.00	0.00
CD (P=0.05)	7.37	9.09	0.07	0.10	1.36	1.81	0.01	0.00

Table 4: Effect of different weed management practices on crop

Treatment	Plant height (cm)	No. of branches plant^{-1}	Pod length (cm)	Number of pods plant^{-1}	Number of seeds pod^{-1}	Test weight (g)	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)	Benefit: Cost
W_1 – Weed free	43.03	5.27	4.53	23.1	6.80	47.0	1109.55	2417.59	30.87	0.96
W_2- Weedy check	32.53	4.20	4.13	13.3	5.27	43.1	624.16	2059.47	26.32	0.53
W_3 – Pendimethalin @ 1 kg ha^{-1} pre-emergence	41.10	4.43	4.33	18.8	5.87	45.6	802.03	2179.86	28.48	1.06
W_4 – Pendimethalin (pre) @ 1 kg ha^{-1} *fb* 1 HW at 25 DAS	39.33	4.43	4.50	21.3	6.53	46.8	910.96	2206.02	30.79	0.96
W_5 – Quizalofop-ethyl @ 50 gethyl @ 50g ha-1 at 25 DAS	41.20	4.40	4.27	16.0	5.93	44.3	809.58	2117.17	30.04	1.18
W_6 – Stale Seed Bed Technique *fb* 1 HW at 25 DAS	40.67	4.30	4.27	20.0	6.23	46.6	854.46	2184.82	29.67	0.79
W_7 - Pendimethalin @ 1 kg ha^{-1} (pre) + Quizalofop-ethyl @ 50 gethyl @ 60 ml ha^{-1}at 25 DAS	42.00	4.50	4.27	17.6	5.90	45.6	778.00	2150.50	28.98	1.03
SEm±	1.26	0.09	0.1	1.2	0.27	2.1	30.20	53.23	1.3	
CD (P=0.05)	3.89	0.27	0.4	3.94	0.82	6.6	93.08	164.04	3.79	

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