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## Effect of pre emergence and post emergence herbicides on weed control in irrigated blackgram

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**Abstract**

Field experiments were conducted to find out the effect of pre and post emergence herbicides and hand weeding practices on weed control and yield of irrigated blackgram at TNAU, Coimbatore during *rabi* season 2011-12 under irrigated condition using recently released blackgram variety Co.6. In this experiment, chemical weed management practice of pre emergence application of Pendimethalin 30 EC + Imazethapyr 2 EC as Vallore 32 @ 0.75 kg and 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS, post emergence application of quizalofop ethyl and imazethapyr each @ 50 g a.i. ha<sup>-1</sup> and their combination at 15 DAS and the sequential application of pendimethalin @ 1.0 kg ha<sup>-1</sup> at 3 DAS followed by either quizalofop ethyl or imazethapyr each @ 50 g a.i. ha<sup>-1</sup> and their combinations were tested against integrated weed management practice of pre emergence application pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup>, Vallore 32 @ 0.75 kg and 1.0 kg ha<sup>-1</sup> with a follow up hand weeding at 30 DAS and hand weeding twice keeping weedy check and weed free check as controls in a randomized block design replicated thrice. Integrated weed management practice of pre emergence application of Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup> with follow up hand weeding recorded 70 and 68 % lowest weed population at 40 and 60 DAS with comparable effect from hand weeding twice, WCE was higher 94.10 and 91.66 per cent respectively, Weed index marginal yield reduction of 2.59 per cent, weed dry weight recorded lesser 19.61 kg ha<sup>-1</sup> and weed density also significantly reduce. Application of Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup> with follow up hand weeding registered significantly taller plants, higher dry matter production, more number of pods per plant, seeds per pod and higher grain yield (1052 kg ha<sup>-1</sup>), net returns (Rs. 32963 ha<sup>-1</sup>) and benefit cost ratio (2.52). Thus, application of pre emergence application of Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup> with one follow up hand weeding recommended as weed management practices on the basis of better weed control, crop yield and economic indices.

**Keywords:** pre emergence, post emergence herbicides and irrigated blackgram

**Introduction**

Blackgram (*Vigna mungo* L. Hepper.) occupies the pride of place among the pulse crops. Being leguminous crops, they have beneficial effect on improving soil fertility through fixation of atmospheric nitrogen. In Tamil Nadu, blackgram covers an area of about 3.41 lakh hectares with the production of 1.21 lakh tonnes and productivity of 355 kg ha<sup>-1</sup> (AICRP on MULLaRP, 2011). Tamil Nadu is not self sufficient in pulses requirement. There is therefore, an urgent need to increase the production of blackgram, the major pulse crop of the state. The main constraint in pulses production is the weed growth which inflicts heavy losses on the crop yield by competing for essential growth factors *viz.*, nutrients, space, light and moisture. Weed management at early stages of crop growth is essential in pulses, since emerging of weeds in pulses begins simultaneously with the crop, leading to severe competition between the crop and weeds (Kandasamy, 2000). Being a short duration crop and initially slow growing in nature, blackgram is heavily infested with grasses, broad-leaved weeds and sedges which compete with crop, resulting in yield reduction (Mishra, 1997). The magnitude of reduction in yield depends upon the weed flora present, quantum of weed flora and duration of crop-weed competition. The maximum crop weed competition in blackgram was observed during the period of 10 to 30 days after sowing. Weed infestation causes 50 to 87 per cent yield reduction in blackgram throughout the growth period of the crop (Sumachandrika *et al.*, 2002; Virendar Sardana *et al.*, 2006). The traditional methods of weed control *viz.*, inter cultivation or hand weeding alone is labour consuming, expensive and insufficient. Moreover, complete weeding during critical crop growth stages is not possible due to increased cost and scarcity of human labour. In addition, continuous rains during early crop growth stages hinder the cultural methods of weed control. Complete control of weeds cannot be achieved by using any one method or single herbicide. Under such circumstances, pre and post emergence herbicides applied in sequence or in combination will control the

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weeds very effectively. Further herbicides and their mixtures are also now available in the market which controls a broad spectrum weeds very effectively. Keeping these points in view the present study was undertaken to find out the effect of pre and post emergence herbicides and hand weeding practices on weed control and yield of irrigated blackgram.

### Materials and Method

Field experiments were conducted at TNAU, Coimbatore during *rabi* season 2011-12 find out the effect of pre and post emergence herbicides and hand weeding practices on weed control and yield of irrigated blackgram at under irrigated condition using recently released blackgram variety Co.6. The soil of the experimental field was Clay loam with pH of 8.2 and EC of 0.18 dS/m. The experimental soil was low, medium and high in available nitrogen, phosphorus and potassium contents, respectively. The experiment was laid out in a randomized block design, comprising of pre emergence application of Pendimethalin 30 EC + Imazethapyr 2 EC as Vallore 32 @ 0.75 kg and 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS, post emergence application of quizalofop ethyl and imazethapyr each @ 50 g a.i. ha<sup>-1</sup> and their combination at 15 DAS and the sequential application of pendimethalin @ 1.0 kg ha<sup>-1</sup> at 3 DAS followed by either quizalofop ethyl or imazethapyr each @ 50 g a.i. ha<sup>-1</sup> and their combinations were tested against integrated weed management practice of pre emergence application pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup>, Vallore 32 @ 0.75 kg and 1.0 kg ha<sup>-1</sup> with a follow up hand weeding at 30 DAS and hand weeding twice keeping weedy check and weed free check as controls. Herbicides were sprayed as per treatments schedule. The blackgram variety "Co.6" was sown at 20 kg/ha seed rate in 30 x 10 cm spacing. Immediately after sowing, light irrigation was applied for ensuring proper germination and establishment of the crop. A non-replicated plot with unweeded control was also maintained to workout weed control efficiency. Observations on weeds dynamics, plant height, yield attributing characters *viz.* pods per plant,

seeds per pod and grain yield were recorded. Weed count was recorded by using 0.25 m<sup>2</sup> quadrat at four places in each plot and expressed as number m<sup>-2</sup>. Square root transformation ( $\sqrt{x+0.5}$ ) was used to analyze the data on weeds. Weed control efficiency was worked out on 20, 40 and 60 DAS and expressed as the percentage reduction in weed density due to weed management practices over control. Economics of weed management was worked out by using the current market price of inputs and blackgram grain. All the recorded data were analyzed statistically as per the method suggested by Gomez and Gomez (1984).

### Results and Discussion

#### Effect on weeds

Weed species like pre and post emergence herbicides and hand weeding practices. The weed flora included five grasses, one sedge and eight broad leaved weeds. These data showed the dominance of broad leaved weeds in the experimental field. The major graminaceous weeds were *Dactyloctenium aegyptium*, *Cynodon dactylon* and *Panicum javanicum*. Along with common cyperaceae weed *Cyperus rotundus*, six families of broad leaved weeds were present in the experimental field, of which *Trianthema portulacastrum*, *Parthenium hysterophorus*, *Boerhaavia diffusa*, *Euphorbia geniculata* and *Flaveria australasica* were important. Weed dynamics on 60 DAS was significantly influenced by post-emergence herbicide.

Absolute density m<sup>-2</sup> and relative density analyses of individual weed species revealed that weed population was the highest at 60 DAS (198.73 m<sup>-2</sup>) as compared to 40 DAS (163.22 m<sup>-2</sup>) and 20 DAS (99.65 m<sup>-2</sup>). The weed flora was dominated by broad leaved weeds with a relative density of 70.97, 70.04 and 67.59 per cent at 20, 40 and 60 DAS respectively. The lower weed density of broad leaved weeds at 60 DAS was compensated with a higher relative density of grasses, while the relative density of sedge weed, and was almost similar and minimum. *Trianthema*

**Table 1:** Effect of pre-emergence and post-emergence herbicides combination on weed density, dry matter production, WCE and growth parameters of irrigated blackgram

Weed management practices	Weed density* (Nos./m <sup>2</sup> ) at 60 DAS				Weed DMP at 60 DAS (kg/ha)	Weed Control Efficiency at 60 DAS (%)	Plant DMP at 60 DAS (kg/ha)	Plant height at 60 DAS (cm)
	Grasses	Sedges	BLW	Total				
T <sub>1</sub> - Hand weeding twice at 20 and 40 DAS	2.41 (3.80)	1.79 (1.20)	3.68 (11.56)	4.31 (16.56)	8.24 (65.82)	90.98	2449	37.81
T <sub>2</sub> - Pendimethalin 1.0 kg a.i. ha <sup>-1</sup> as PE (3 DAS) + One Hand weeding at 20 DAS	3.36 (9.32)	2.33 (3.41)	5.46 (27.85)	6.53 (40.58)	10.97 (118.31)	83.78	2460	36.32
T <sub>3</sub> - Quizalofop ethyl @ 50 g a.i. ha <sup>-1</sup> as EPOE (15 DAS)	4.14 (15.15)	3.72 (11.87)	8.59 (71.83)	10.04 (98.85)	23.45 (548.03)	24.86	1604	22.96
T <sub>4</sub> - Imazethapyr @ 50 g a.i. ha <sup>-1</sup> as EPOE (15 DAS)	5.72 (30.70)	3.56 (10.69)	6.48 (40.03)	9.13 (81.42)	19.50 (378.29)	48.13	2028	23.7
T <sub>5</sub> - Quizalofop ethyl @ 50 g a.i. ha <sup>-1</sup> + Imazethapyr @ 50 g a.i. ha <sup>-1</sup> EPOE (15 DAS)	4.05 (14.40)	3.26 (8.64)	5.63 (29.65)	7.40 (52.69)	18.21 (329.51)	54.82	2223	24.59
T <sub>6</sub> - Pendimethalin 1.0 kg a.i. ha <sup>-1</sup> as PE (3 DAS) + Quizalofop ethyl @ 50 g a.i. ha <sup>-1</sup> as EPOE (15 DAS)	3.91 (13.26)	3.06 (7.35)	5.44 (27.60)	7.09 (48.21)	17.15 (292.06)	59.96	2291	28.30
T <sub>7</sub> - Pendimethalin 1.0 kg a.i. ha <sup>-1</sup> PE (3 DAS) + Imazethapyr @ 50g a.i. ha <sup>-1</sup> as EPOE (15 DAS)	4.91 (22.06)	3.17 (8.02)	3.93 (13.45)	6.75 (43.53)	15.80 (247.58)	66.06	2375	29.41
T <sub>8</sub> - Pendimethalin 1.0 kg a.i. ha <sup>-1</sup> as PE (3 DAS) + Imazethapyr @ 50g a.i. ha <sup>-1</sup> as EPOE (15 DAS) + Quizalofop ethyl @ 50 g a.i./ha POE (20 DAS)	3.51 (10.31)	2.92 (6.54)	4.67 (19.77)	6.21 (36.62)	13.21 (172.43)	76.36	2508	34.78
T <sub>9</sub> - Pendimethalin 1.0 kg a.i. ha <sup>-1</sup> as PE (3 DAS) + Quizalofop ethyl @ 50g a.i. ha <sup>-1</sup> as EPOE + Imazethapyr @ 50 g a.i. ha <sup>-1</sup> as EPOE (15 DAS)	3.54 (10.51)	2.93 (6.61)	4.72 (20.24)	6.27 (37.36)	13.51 (180.39)	75.27	2530	35.03

T <sub>10</sub> -Vallore32 (Pendimethalin 30EC + Imazethapyr 2EC) @ 0.75 kg a.i ha <sup>-1</sup> as PE (3DAS)	4.04 (14.34)	2.58 (4.68)	4.70 (20.09)	6.41 (39.11)	13.99 (193.70)	73.44	2416	33.69
T <sub>11</sub> -Vallore32 @ 1.00 kg a.i ha <sup>-1</sup> as PE (3DAS)	3.76 (12.17)	2.46 (4.06)	3.74 (11.99)	5.50 (28.22)	11.96 (140.95)	80.68	2465	36.11
T <sub>12</sub> -Vallore32 @ 0.75 kg a.i ha <sup>-1</sup> as PE (3DAS) + One Hand weeding at 30 DAS	2.64 (4.98)	1.85 (1.43)	4.14 (15.10)	4.85 (21.51)	10.71 (112.76)	84.54	2675	39.62
T <sub>13</sub> -Vallore @ 32 1.00 kg a.i ha <sup>-1</sup> as PE (3DAS) + One Hand weeding at 30 DAS	2.57 (4.61)	1.84 (1.39)	3.20 (8.25)	4.03 (14.25)	7.93 (60.84)	91.66	2827	44.23
T <sub>14</sub> -Weedy check	7.25 (50.57)	3.98 (13.84)	11.68 (134.32)	14.17 (198.73)	27.04 (729.37)	0.00	1288	21.53
T <sub>15</sub> -Weed free check	1.41 (0.00)	1.41 (0.00)	1.41 (0.00)	1.41 (0.00)	1.41 (0.00)	100.00	2869	44.69
SEd	0.27	0.23	0.44	0.27	0.81	-	65.72	2.28
CD (P=0.05)	0.55	0.47	0.90	0.55	1.66	-	134.53	4.68

*portulacastrum* in broad leaved weeds, was the predominant weed species constituted higher proportion of total weed flora with a relative density of 34.40, 38.48 and 43.08 per cent respectively during 20, 40 and 60 DAS. Among the grasses, *Dactyloctenium aegyptium* constituted higher proportion with a relative density of 8.46, 9.39 and 10.18 per cent whereas *Cyperus rotundus* was the only sedge weed contributed to the proportion of weed flora with a relative density of 7.54, 5.92 and 6.96 per cent respectively at 20, 40 and 60 DAS.

Total weed density (7.93 /m<sup>2</sup>) and weed dry weight (8.24 kg/ha) were minimum under combined application of pre emergence application of Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup> with one follow up hand weeding. In general, weedy check registered higher weed dry weight than all other treatments. Higher weed control efficiency (WCE) of 91.66% was obtained with pre emergence application of Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup>. However, this was comparable with Hand weeding twice at 20 and 40 DAS registered higher WCE of 90.98%. Raman and Krishnamoorthy (2005) observed that application of pendimethalin @ 1.0 kg ha<sup>-1</sup> as pre emergence at 3 DAS with one hand weeding at 20 DAS recorded significantly lower weed number, weed dry weight and higher WCE in mungbean. Dhaker *et al.* (2010) also reported that hand weeding at later stages recorded higher WCE.

#### Effect on crop

**Growth characters:** Application Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup> recorded significantly taller plants (44.23cm) and higher dry matter production (DMP) (2827 kg/ha). However, this was comparable with Hand weeding twice at 20 and 40 DAS. This might be due to better weed control by the herbicides resulted in lesser weed completion and higher plant height. Between herbicides, taller plants were noticed with application of Vallore32 @ 0.75 kg a.i ha<sup>-1</sup> as PE (3DAS) + One Hand weeding at 30 DAS. The minimum DMP was registered under Quizalofop ethyl @ 50 g a.i. ha<sup>-1</sup> as EPOE (15 DAS) mainly due to higher competition from weeds.

#### Yield attributes and yield:

Maximum number of pods per plant (47.60) was registered under application of Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup>. This was comparable with application of Vallore32 @ 0.75 kg a.i ha<sup>-1</sup> as PE (3DAS) + One Hand weeding at 30 DAS. Application of Quizalofop ethyl @ 50 g a.i. ha<sup>-1</sup> as EPOE (15 DAS) alone recorded lesser number of pods per plant. Presence of greater competition from broad-leaved weeds caused significant reduction in yield attributes of blackgram. Number of seeds per pod was higher under application of Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup>. Lesser number of seeds per pod was obtained with application of Quizalofop ethyl @ 50 g a.i. ha<sup>-1</sup> as EPOE (15 DAS). There was not much variation in 1000-grain weight of blackgram due to weed management practices. Higher mean grain yield of 1052 kg/ha was obtained with the application Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup>. This might be due to the broad spectrum control of weeds by the herbicides during early stages resulted in lesser weed competition that favoured better growth and yield parameters and grain yield of blackgram. Imazethapyr controlled the broad-leaved weeds and to some extent reduced the growth of sedges whereas quizalofop ethyl controlled the grasses that led to minimum weed competition and higher grain yield of blackgram. Between the herbicides used, imazethapyr recorded higher grain yield than quizalofop ethyl at all the levels. Better weed control and higher grain of chickpea due to application of imazethapyr was reported by Kachhadiya *et al.* (2009).

**Economic analysis:** Economic analysis of herbicidal weed management in blackgram revealed that application of Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup> gave the highest net returns in both the years with the net return of Rs. 32963/ha (Table 2). This was followed by application of both Vallore32 @ 0.75 kg a.i ha<sup>-1</sup> as PE (3DAS) + One Hand weeding at 30 DAS and Hand weeding twice at 20 and 40 DAS. Higher benefit cost ratio (BCR) was obtained with application of Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup> (2.52) mainly due to better

**Table 2:** Effect of pre-emergence and post-emergence herbicides combination on yield attributes, grain yield and economics of irrigated blackgram

Weed management practices	Pods/plant	No. of seeds /pod	Test weight (g)	Grain yield (Kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
T <sub>1</sub>	44.19	5.57	5.32	972	28630	2.31
T <sub>2</sub>	43.58	5.53	5.30	905	25550	2.19
T <sub>3</sub>	19.50	4.89	4.89	427	2780	1.14
T <sub>4</sub>	26.80	5.08	4.92	596	12598	1.68
T <sub>5</sub>	27.40	5.12	5.02	684	15664	1.79
T <sub>6</sub>	33.80	5.21	5.06	749	17428	1.81
T <sub>7</sub>	35.50	5.28	5.12	795	20850	2.02
T <sub>8</sub>	38.52	5.34	5.18	842	21784	1.99
T <sub>9</sub>	39.30	5.38	5.20	857	22664	2.03
T <sub>10</sub>	36.04	5.33	5.17	802	22222	2.14
T <sub>11</sub>	40.14	5.52	5.26	873	25155	2.24
T <sub>12</sub>	45.10	5.64	5.35	991	30550	2.46
T <sub>13</sub>	47.60	5.91	5.78	1052	32963	2.52
T <sub>14</sub>	17.40	4.26	4.63	386	2158	1.12
T <sub>15</sub>	48.00	5.92	5.83	1080	30246	2.17
SEd	2.19	0.51	0.49	40.26	-	-
CD (P=0.05)	4.48	NS	NS	82.41	-	-

weed control and higher grain yield with minimum expenditure. Minimum net returns (Rs. 2780/ha) and BCR (1.14) were noticed with application of Quizalofop ethyl @ 50 g a.i. ha<sup>-1</sup> as EPOE (15 DAS) mainly due to its poor weed control efficiency under irrigated condition. The cost effectiveness of imazethapyr as post emergence herbicide in soybean was reported by Meena *et al.* (2011). Thus, the application Pendimethalin 30 EC + Imazethapyr 2EC as Vallore 32 @ 1.0 kg a.i. ha<sup>-1</sup> of found to be effective in controlling of emerged weeds, higher grain yield and economic returns of irrigated blackgram.

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