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Bio-efficacy of Sorghum Extract and Herbicide on Weed Dynamics and Productivity of Wheat in Western Rajasthan

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ABSTRACT

Background: Integrated application of sorghum extract along with herbicides are viable option for reducing herbicidal dose and their effect in soil and plant. This led to reduce environmental pollution as well as check the growth of weeds in the crop without having detreating effect on crop. Therefore, an integrated approaches involving botanicals conjunctive with herbicide will be the alternatives to reduce post-effects of herbicide. Sorgoleone is the allelochemicals which is present in sorghum and having potential to suppress the growth of weeds at early stage by checking water and nutrient absorption. The basic aim of the study to calibrate the potential of sorghum extract on weed suppression as well as to reduce the quantity of herbicides in wheat crop.

Methods: A field experiment entitled "Bio-efficacy of sorghum extract and herbicide on weed dynamics and productivity of wheat in western Rajasthan" was conducted at Instructional Farm, College of Agriculture, Jodhpur (Rajasthan) during *rabi* season of 2021-22. The experiment was conducted in randomized block design replicated thrice and comprised of eleven treatments of weed management practices.

Result: Sequential application of sorghum extract (1:3) + ready-mix of clodinafop + metsulfuron 64 g/ha as post-emergence was found to be the most effective in controlling weeds which led to significant reduction in weed density and weed dry weight with highest weed control efficiency showed significant superiority over all treatments.

Key words: Herbicide, Sorghum extract, Weed index, Weed management, Wheat, Yield.

INTRODUCTION

Wheat [*Triticum aestivum* (L.)] is one of the most important crop among the cereals in the world and belongs to family *'Poaceae'*. In 100 gram of wheat contains 71 gram of carbohydrate, 14 gram of protein, 2.5 gram of fat, 2 gram of minerals and significant amounts of vitamins and minerals are present (Patil *et al*., 2023). Wheat is cultivated an area of about 2.84 million hectare area with a production of 11.11 million tonnes and productivity of 3913 kg/ha, which is greater than the national average productivity (Commissionerate of Agriculture, 2022).

Among various pests, weeds are known to cause heavy loss in wheat crop. Numerous studies revealed that more than one-third of the total yield losses were mainly due to biotic stresses *i.e*. weeds (Mesterhazy *et al*., 2020). The productivity of wheat has fallen due to various constraints such as biotic and abiotic factors. Poor weed management practices are most important yield reduction factors in wheat (Yadav *et al*., 2019). Weeds are major limiting biotic factors in wheat and it reduces 17 to 30 per cent yield losses in wheat annually (Goudar *et al*., 2020). Under arid conditions of Western Rajasthan, both grassy and broad leaf weeds are dominant. Singh and Singh (2004) from Jodhpur reported that 42.8 per cent reduction in yield of wheat crop due to weed infestation. It was seeming that early management of weeds in wheat crop may enhanced yield due to lesser crop-weed competition. Wheat crop is infested with both grassy as well as broad leaf weeds and cause yield loss of 7 to 50 per cent depending upon the species of weed flora and their intensity (Choudhary *et al*., 2016). Use of botanicals having good allelopathic effect may be best viable option for managing weeds in wheat that cut-down the heavy dose of herbicides. It is feasible with sorghum extract which reduces weed infestation at a very early stage of crop. Application of allelopathy is totally a natural and eco-friendly method for the management of weeds and ultimately growth and yield of the crop increased. Allelopathy is a natural phenomenon in which different organism affects the functioning of other organisms in their vicinity by releasing secondary metabolites negatively or positively (Huang *et al*., 2021)

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and also some time it linked with abiotic stresses in plant. It was observed that application of allelochemicals at lower concentrations, have positive impacts on crop performance.

Among various allelopathic crops, sorghum is one of the most allelopathic crops that having many number of allelochemicals which suppresses the growth of weeds (Jabran *et al*., 2015). Many secondary metabolites such as phenolic, alkaloids, flavonoids and terpeniods are identified in sorghum plant (Jabran *et al*., 2015). Murimwa *et al*. (2019) observed that the foliar application of sorghum water extract reduced weed density and dry weight by 15 to 17% and 19 to 49%, respectively in sesame crop. However, its allelopathic effect is depending on concentration of extract. Liquid extract of sorghum in low concentration has stimulatory effects on germination and growth of weeds. Cheema *et al*. (2020) reported that water extract spray reduced weed biomass by 35 to 40 per cent and increased wheat yield by 10 to 21 per cent. The suitable weed management is crucial to improve wheat production without damaging environment. Therefore, this study was carried out to enumerate the effect of sorghum extract and herbicides on weed density, weed dry weight, weed control efficiency, weed index and grain yield of wheat.

MATERIALS AND METHODS

A one year field experiment was conducted during *rabi* season of 2021-22 at Instructional Farm, College of Agriculture, Jodhpur (Rajasthan) India. The soil of the experimental fields was sandy-loamy in texture having pH 8.2 and non-saline in conductivity (EC 0.12 dS/m), low in organic carbon (0.14%), low in available nitrogen (177.0 kg/ha), whereas medium in available phosphorus (22.0 kg/ha) and high in available potassium (330.0 kg/ha). The experiment was laid down in randomized block design (RBD) and replicated thrice. The experiment comprised of eleven treatments of weed management practices *viz*. sorghum extract (1:1), Sorghum extract (1:2), Sorghum extract (1:3), Sorghum extract (1:4), Ready mix of clodinafop + metsulfuron 64 g/ha, Sorghum extract (1:1) + ready-mix of clodinafop + metsulfuron 64 g/ha, Sorghum extract (1:2) + ready-mix of clodinafop + metsulfuron 64 g/ha, Sorghum extract (1:3) + ready-mix of clodinafop + metsulfuron 64 g/ha, Sorghum extract (1:4) + ready-mix of clodinafop + metsulfuron 64 g/ha, weed free and weedy check. Chopped stover of crop was soaked in tape water in ratio of 1:10 (w/v) and kept for 24 hours as such for release of maximum amount of allelochemicals into water. Afterwards, keeping sorghum extract as one part and diluted with water as per the treatments by using different ratio *viz*. 1:1, 1:2, 1:3 and 1:4 each in knapsack spray and sprayed at 21 days after sowing of wheat as per the ready-mix application. Clodinafop + metsulfuron 64 g/ha as post-emergence with 500 liters of water with the help of knapsack sprayer, fitted with flat-fan nozzle. Species wise weed counts at 30, 60, 90 DAS and at harvest stage by (0.50 m × 0.50 m) quadrate in each plot and expressed as numbers per square meter. The mean data were subjected to square root transformation $\sqrt{(x + 0.5)}$ to normalize their distribution (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect on weed density

The efficiency of different sorghum extract and herbicidal treatments on density of different weed species and total weed density resulted in significant variation on its count at each stage of the crop growth except at 30 DAS (Table 1, 2 and 3). Data revealed that sequential and post-emergence application of sorghum extract (1:3) + ready-mix of clodinafop + metsulfuron 64 g/ha recorded significantly lower density of *Chenopodium murale* (2.03, 1.63 and 1.51/m^2), *Chenopodium album* (2.02, 1.42 and 1.32/m^2), *Asphodelus tenuifolius* (2.36, 1.85 and 1.47/m^2), *Cyperus rotundus* (1.85, 1.63 and 1.36/m^2) and *Rumex dentatus* (1.56, 1.29 and 0.92/m^2) which was at par with sorghum extract (1:2) + ready-mix of clodinafop + metsulfuron 64 g/ha. Alone application of sorghum extract also found effective in reducing weed density as compared to weedy check. Sorghum extract affecting several physiological processes including inhibition of nutrient uptake, mitotic inhibition, photosynthetic inhibition in weed plant (Naeem *et al*., 2018). Sequential application of sorghum extract (1:3) + ready-mix of clodinafop + metsulfuron 64 g/ha significantly reduces total weed density (4.20, 3.27 and 2.66/m^2) which was closely by sorghum extract (1:2) + ready-mix of clodinafop + metsulfuron 64 g/ha which also outplayed in reducing total weed density (5.57, 4.77 and 4.29/m^2) at different growth stages of wheat (Table 3). Clodinafop-propargyl is basically *Acetyl Co-A carboxylase* (ACCase) inhibitor most effective in controlling annual grassy weeds in wheat. Metsulfuron-methyl is basically an *Acetolactate Synthase* (ALS) enzyme inhibitor, a enters into the plant through root as well as foliage. This results in rapid inhibition of cell division and growth in the plant (Das, 2015).

Effect on total weed dry weight

Data pertaining to total dry weight of weeds recorded at 30, 60, 90 DAS and at harvest indicated marked variations due to integrated application of different dilution level of sorghum extract and herbicidal treatments at all growth stages except at 30 DAS (Table 4). Post-emergence application of sorghum extract (1:3) + ready-mix of clodinafop + metsulfuron 64 g/ha recorded significantly lesser quantity of total weed dry weight (2.99, 3.15 and 3.55 g/m^2) followed by the treatment sprayed with sorghum extract (1:2) + ready-mix of clodinafop + metsulfuron 64 g/ha, which also showed their significant effects on reducing total weed dry weight (3.35, 3.72 and 4.01 g/m^2) different growth stages of wheat (Table 4). Alone application of sorghum extract also found effective in reducing weed dry weight as compared to weedy check. It was might be duet to sorghum extracts reduces weed dry weight by affecting

Table 1: Density of *Chenopodium murale and Chenopodium album* in wheat as influenced by sorghum extract and herbicide.

Treatments	*Chenopodium murale* (No./m²)				*Chenopodium album* (No./m²)			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
Sorghum extract (1:1)	7.30 (52.77)	6.85 (46.37)	6.47 (41.32)	5.59 (30.72)	5.86 (33.77)	5.45 (29.23)	5.07 (25.23)	4.84 (22.90)
Sorghum extract (1:2)	6.69 (44.27)	5.48 (29.53)	4.98 (24.35)	4.47 (19.50)	5.07 (25.27)	4.78 (22.39)	4.14 (16.67)	3.76 (13.64)
Sorghum extract (1:3)	6.54 (42.26)	5.08 (25.26)	4.76 (22.13)	3.99 (15.52)	4.88 (23.26)	4.37 (18.61)	3.73 (13.45)	3.38 (10.97)
Sorghum extract (1:4)	6.85 (46.37)	6.33 (39.56)	5.76 (32.66)	5.42 (28.83)	5.28 (27.37)	5.28 (27.30)	4.88 (23.34)	4.62 (20.86)
Ready mix of clod. + met. 64 g/ha	7.58 (56.95)	5.97 (35.20)	5.55 (30.32)	5.21 (26.61)	6.20 (37.95)	4.98 (24.34)	4.44 (19.23)	4.22 (17.34)
Sorghum extract (1:1) + ready-mix of clod. + met. 64 g/ha	7.29 (52.60)	4.62 (20.89)	4.24 (17.45)	3.65 (12.83)	5.84 (33.60)	3.84 (14.28)	3.32 (10.56)	2.95 (8.23)
Sorghum extract (1:2) + ready-mix of clod. + met. 64 g/ha	6.69 (44.18)	3.09 (9.34)	2.68 (6.90)	2.39 (5.34)	5.07 (25.18)	2.90 (7.90)	2.41 (5.30)	2.32 (4.90)
Sorghum extract (1:3) + ready-mix of clod. + met. 64 g/ha	6.51 (42.00)	2.03 (3.69)	1.63 (2.50)	1.51 (1.80)	4.82 (23.00)	2.02 (3.61)	1.42 (1.51)	1.32 (1.34)
Sorghum extract (1:4) + ready-mix of clod. + met. 64 g/ha	6.89 (46.95)	3.97 (15.45)	3.65 (12.96)	3.12 (9.25)	5.25 (27.07)	3.31 (10.50)	2.99 (8.43)	2.81 (7.43)
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)	0.71 (0.00)	0.71 (0.00)
Weedy check	7.64 (57.88)	7.79 (60.15)	8.12 (65.50)	8.32 (68.78)	6.28 (38.88)	6.83 (46.31)	6.99 (48.53)	7.50 (55.86)
SEm±	0.08	0.14	0.20	0.13	0.12	0.11	0.10	0.12
CD (*P*=0.05)	NS	0.42	0.58	0.37	NS	0.33	0.28	0.36

*Data subjected to square root transformation (√X+0.5), value in parentheses represent original value (clod. + met. - clodinafop + metsulfuron).

Table 2: Density of *Asphodelus tenuifolius* and *Cyperus rotundus* in wheat as influenced by sorghum extract and herbicide.

Treatments	*Asphodelus tenuifolius* (No./m²)				*Cyperus rotundus* (No./m²)			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
Sorghum extract (1:1)	3.90 (14.70)	3.54 (12.03)	3.22 (9.90)	3.03 (8.70)	3.14 (9.32)	3.07 (8.94)	3.02 (8.64)	2.90 (7.92)
Sorghum extract (1:2)	3.79 (13.88)	3.36 (10.83)	3.03 (8.70)	2.83 (7.50)	3.02 (8.65)	2.67 (6.61)	2.62 (6.38)	2.54 (5.98)
Sorghum extract (1:3)	3.73 (13.44)	3.32 (10.52)	2.98 (8.39)	2.77 (7.19)	2.95 (8.23)	2.55 (6.02)	2.53 (5.88)	2.43 (5.39)
Sorghum extract (1:4)	3.85 (14.34)	3.50 (11.77)	3.34 (10.64)	2.93 (8.10)	3.09 (9.06)	2.92 (8.07)	2.90 (7.92)	2.74 (7.01)
Ready mix of clod. + met. 64 g/ha	3.97 (15.23)	3.39 (11.04)	3.07 (8.91)	2.87 (7.71)	3.23 (9.95)	2.81 (7.39)	2.77 (7.17)	2.69 (6.72)
Sorghum extract (1:1) + ready-mix of clod. + met. 64 g/ha	3.89 (14.65)	3.25 (10.06)	2.90 (7.93)	2.69 (6.73)	3.15 (9.39)	2.43 (5.40)	2.32 (4.92)	2.16 (4.17)
Sorghum extract (1:2) + ready-mix of clod. + met. 64 g/ha	3.75 (13.58)	2.77 (7.20)	2.36 (5.07)	2.09 (3.87)	2.97 (8.33)	2.03 (3.61)	1.87 (3.00)	1.70 (2.39)
Sorghum extract (1:3) + ready-mix of clod. + met. 64 g/ha	3.71 (13.28)	2.36 (5.08)	1.85 (2.95)	1.47 (1.75)	2.92 (8.03)	1.85 (2.93)	1.63 (2.17)	1.36 (1.35)
Sorghum extract (1:4) + ready-mix of clod. + met. 64 g/ha	3.92 (14.85)	3.19 (9.68)	2.84 (7.55)	2.62 (6.38)	3.16 (9.49)	2.31 (4.83)	2.16 (4.17)	1.99 (3.50)
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)	0.71 (0.00)	0.71 (0.00)
Weedy check	3.99 (15.46)	4.41 (18.97)	4.93 (23.88)	5.21 (26.71)	3.26 (10.14)	3.96 (15.16)	4.71 (21.73)	4.97 (24.23)
SEm±	0.06	0.08	0.08	0.09	0.03	0.04	0.05	0.05
CD (*P*=0.05)	NS	0.24	0.25	0.27	NS	0.11	0.15	0.15

*Data subjected to square root transformation (√X+0.5), value in parentheses represent original value (clod. + met. - clodinafop + metsulfuron).

Table 3: Density of *Rumex dentatus* and total weed density in wheat as influenced by sorghum extract and herbicide.

Treatments	*Rumex dentatus* (No./m^2)				Total weed density (No./m^2)			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
Sorghum extract (1:1)	2.97 (8.32)	2.91 (7.94)	2.85 (7.60)	2.72 (6.92)	10.93 (118.89)	10.25 (104.51)	9.65 (92.66)	8.81 (77.16)
Sorghum extract (1:2)	2.85 (7.65)	2.47 (5.61)	2.42 (5.38)	2.34 (4.98)	10.01 (99.71)	8.69 (74.97)	7.87 (61.48)	7.22 (51.59)
Sorghum extract (1:3)	2.78 (7.23)	2.35 (5.02)	2.32 (4.88)	2.21 (4.39)	9.74 (94.43)	8.12 (65.42)	7.43 (54.73)	6.63 (43.46)
Sorghum extract (1:4)	2.93 (8.06)	2.75 (7.07)	2.72 (6.92)	2.55 (6.01)	10.28 (105.21)	9.71 (93.77)	9.06 (81.48)	8.44 (70.81)
Ready mix of clod. + met. 64 g/ha	3.07 (8.95)	2.62 (6.39)	2.58 (6.17)	2.49 (5.72)	11.38 (129.03)	9.21 (84.35)	8.50 (71.79)	8.04 (64.10)
Sorghum extract (1:1) + ready-mix of clod. + met. 64 g/ha	2.98 (8.39)	2.21 (4.40)	2.09 (3.92)	1.92 (3.17)	10.91 (118.63)	7.45 (55.03)	6.73 (44.78)	5.97 (35.13)
Sorghum extract (1:2) + ready-mix of clod. + met. 64 g/ha	2.79 (7.33)	1.76 (2.61)	1.58 (2.00)	1.37 (1.39)	9.95 (98.59)	5.57 (30.66)	4.77 (22.27)	4.29 (17.89)
Sorghum extract (1:3) + ready-mix of clod. + met. 64 g/ha	2.74 (7.03)	1.56 (1.93)	1.29 (1.17)	0.92 (0.35)	9.67 (93.35)	4.20 (17.24)	3.27 (10.29)	2.66 (6.59)
Sorghum extract (1:4) + ready-mix of clod. + met. 64 g/ha	3.00 (8.49)	2.08 (3.83)	1.92 (3.17)	1.72 (2.50)	10.36 (106.84)	6.69 (44.29)	6.06 (36.28)	5.44 (29.06)
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)	0.71 (0.00)	0.71 (0.00)
Weedy check	3.11 (9.15)	3.60 (12.45)	3.97 (15.24)	4.33 (18.27)	11.49 (131.50)	12.39 (153.04)	13.24 (174.89)	13.94 (193.85)
SEm±	0.03	0.04	0.06	0.06	0.114	0.113	0.107	0.095
CD (*P*=0.05)	NS	0.12	0.16	0.17	NS	0.333	0.315	0.281

*Data subjected to square root transformation (√X+0.5), value in parentheses represent original value (clod. + met. - clodinafop + metsulfuron).

several physiological processes including inhibition of nutrient uptake, mitotic inhibition, photosynthetic inhibition, effects on membrane permeability and production of reactive oxygen species that weaker the weeds through improper assimilation and their storage in the sink. Similar results were reported by Naeem *et al*. (2018); Singh *et al.* (2017). clodinafop-propargyl able to control grass weeds in wheat, triticale and rye. Metsulfuron-methyl basically is an *Acetolactate Synthase* (ALS) enzyme inhibitor, a key enzyme required in the biosynthesis of essential amino-acids *viz*. valine and isoleucine in plant. This results in rapid inhibition of cell division and growth in the plant (Das, 2015).

Effect on weed control efficiency

Higher weed control efficiency was recorded with sequential application of sorghum extract (1:3) + ready-mix of clodinafop + metsulfuron 64 g/ha which was by sorghum extract (1:2) + ready-mix of clodinafop + metsulfuron 64 g/ha at all growth stages of crop at their respective sequence and attained highest efficacy (Table 5). This may be due to sorghum extract and herbicidal treatments supress the weed growth and provided favourable conditions for crop growth which ultimately increased the grain yield of wheat. Similar trends in weed control efficiency were also recorded by Desmukh *et al*. (2020).

Effect on weed index

Lower weed index was recorded post-emergence and sequential application of sorghum extract (1:3) + ready-mix of clodinafop + metsulfuron 64 g/ha which was by sorghum extract (1:2) + ready-mix of clodinafop + metsulfuron 64 g/ha also showed minimum yield loss in terms of weed index (Table 5). The loss of yield was maximum was observed under weedy check due to heavy infestation of weeds. Similar trends in weed index were also recorded by Desmukh *et al*. (2020). These results were in lines that alllelopathic compounds of sorghum mostly kills all species of weeds in wheat crop through inhibits overall functions of chloroplast and mitochondrial. (Cheema *et al*., 2020).

Effect on grain yield

Significantly higher grain yield of wheat was obtained with weed free this might be possible due to season long weeding which could be attributed toward better utilization of applied inputs. Thereafter, sequential application of sorghum extract (1:3) + ready-mix of clodinafop + metsulfuron 64 g/ha as post emergence, recorded significantly higher grain yield 4543 kg/ha with 34.87% increase in yield magnitude of increments were 34.87% over weedy check which was at par with sorghum extract (1:2) + ready-mix of clodinafop + metsulfuron 64 g/ha (Table 5). Sorghum extract and herbicide suppress the initial growth of weed and increase the nutrient availability by crop as well as increase metabolic functions like cell division and

Table 4: Total weed dry weight in wheat as influenced by sorghum extract and herbicide.

Treatments	Total weed dry weight (g/m^2)			
	30 DAS	60 DAS	90 DAS	At harvest
Sorghum extract (1:1)	2.51 (5.82)	4.66 (21.22)	5.19 (26.42)	6.06 (36.20)
Sorghum extract (1:2)	2.09 (3.87)	4.24 (17.53)	4.66 (21.20)	5.40 (28.64)
Sorghum extract (1:3)	1.75 (2.55)	4.12 (16.53)	4.36 (18.53)	5.10 (25.53)
Sorghum extract (1:4)	2.32 (4.87)	4.43 (19.09)	4.98 (24.36)	5.82 (33.42)
Ready mix of clod. + met. 64 g/ha	2.76 (7.11)	4.32 (18.20)	4.80 (22.53)	5.47 (29.42)
Sorghum extract (1:1) + ready-mix of clod. + met. 64 g/ha	2.44 (5.43)	3.82 (14.09)	4.23 (17.40)	4.78 (22.30)
Sorghum extract (1:2) + ready-mix of clod. + met. 64 g/ha	1.93 (3.24)	3.35 (10.73)	3.72 (13.31)	4.01 (15.62)
Sorghum extract (1:3) + ready-mix of clod. + met. 64 g/ha	1.66 (2.26)	2.99 (8.42)	3.15 (9.42)	3.55 (12.09)
Sorghum extract (1:4) + ready-mix of clod. + met. 64 g/ha	2.13 (4.21)	3.75 (13.62)	4.05 (15.87)	4.60 (20.65)
Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)
Weedy check	2.89 (7.89)	7.47 (55.30)	8.95 (79.62)	10.94 (119.15)
SEm±	0.083	0.042	0.033	0.036
CD (*P*=0.05)	NS	0.124	0.097	0.106

*Data subjected to square root transformation (√X+0.5), value in parentheses represent original value (clod. + met. - clodinafop + metsulfuron).

Table 5: Weed control efficiency, weed index and grain yield of wheat as influenced by sorghum extract and herbicide.

Treatments	Weed control efficiency (%)				Weed index (%)	Grain yield (kg/ha)
	30 DAS	60 DAS	90 DAS	At harvest		
Sorghum extract (1:1)	26.05	61.65	66.80	69.61	30.05	3392
Sorghum extract (1:2)	50.82	68.28	73.36	75.95	21.34	3815
Sorghum extract (1:3)	67.64	70.09	76.72	78.57	18.91	3933
Sorghum extract (1:4)	38.11	65.46	69.39	71.95	26.08	3584
Ready mix of clod. + met. 64 g/ha	9.60	67.07	71.69	75.30	23.18	3726
Sorghum extract (1:1) + ready-mix of clod. + met. 64 g/ha	30.99	74.50	78.14	81.28	17.55	3999
Sorghum extract (1:2) + ready-mix of clod. + met. 64 g/ha	58.80	80.58	83.28	86.88	13.05	4217
Sorghum extract (1:3) + ready-mix of clod. + met. 64 g/ha	71.24	84.76	88.16	89.85	6.32	4543
Sorghum extract (1:4) + ready-mix of clod. + met. 64 g/ha	47.67	75.35	80.05	82.66	15.14	4116
Weed free	100.00	100.00	100.00	100.00	0.00	4850
Weedy check	0.00	0.00	0.00	0.00	38.99	2959
SEm±	-	-	-	-	-	36.42
CD (*P*=0.05)	-	-	-	-	-	107.43

(clod. + met. - clodinafop + metsulfuron).

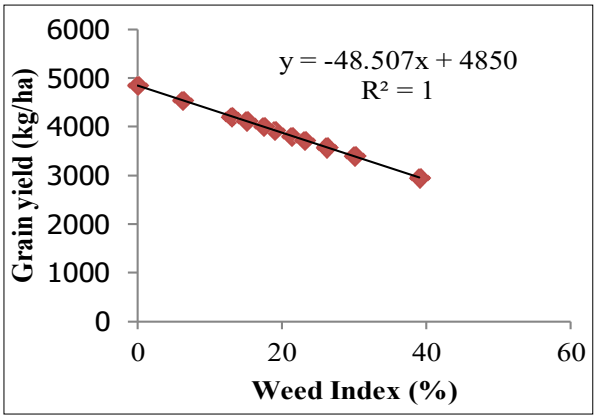

Fig 1: Regression analysis between grain yield (kg/ha) and weed index (%) of wheat.

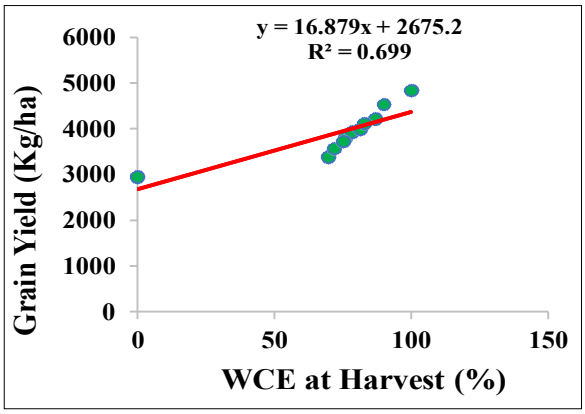

Fig 2: Regression analysis between grain yield (kg/ha) and weed control efficiency at harvest (%) of wheat.

photosynthesis, which resulted in higher (Naby and Ali, 2020).

Regression studies

It was noticed that grain yield of wheat negatively correlated with weed index that shown correlation co-efficient of 1.00. This was further supported by the regression analysis; the grain yield of wheat was decreased by 48.507 kg/ha (Fig 1) in terms of weed index. The grain yield and weed control efficiency was positively correlated with correlation co-efficient of 0.699. This was further proved by regression analysis; the grain yield of wheat was increased by 16.85 kg/ha (Fig 2).

CONCLUSION

Based on one year experimental results, it may concluded that sequential application of sorghum extract (1:3) + ready-mix of clodinafop + metsulfuron 64 g/ha was found effective in reducing weed infestation and realized higher grain yield.

Conflict of interest

Authors have declared no conflict of interests exist.

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