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Management of Striga (Striga hermonthica) in Sorghum (Sorghum bicolor L.) in Jeldu District

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Abstract
A field experiment was conducted from 2017 to 2018 to determine the chemical herbicides which can best perform against Striga in sorghum fields of Jeldu district, West Shoa Zone. The experiment was carried out in randomized complete block design with three replications. Result obtained indicted that, sorghum plant height, stock biomass, grain yield and thousand seed weight showed significantly different ($P<0.05$) among treatments. The highest mean plant height (240.92 cm), stock biomass (13967 kg/ha), grain yield (886.2 kg/ha) and thousand seed weight (24.3 g) were recorded from the sequential application of Metalachlor 960 EC + 2, 4-D as compared to weedy check. The lowest Striga height (31.917 cm) was recorded from sequential application of Metalachlor 960 EC + 2, 4-D. Similarly the lowest Striga biomass were recorded from farmers practice followed by kerosene (for seed dressing) and sequential application of Metalachlor 960 EC + 2, 4-D. Therefore, sequential application of Metalachlor 960 EC + 2, 4-D is recommended as one component of integrated Striga management in sorghum field.
Keywords: Sorghum bicolor L, Striga hermonthica, Dual gold and 2, 4-D
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Introduction

Ethiopia is the home of origin for sorghum varieties cultivated worldwide. Sorghum is one the most important cereal in the world, only exceeded by wheat and rice as staple food in the tropics and raw materials for many industrial products in Ethiopia.

Striga hermonthica that belongs to Orobanchaceae family is one of the cereal crops root parasite often causing 30-100% crop losses on farmers' fields throughout the world (Ouedraogo, 1992). It is an important biotic constraint to sorghum and maize crop production, and the weed that farmers fear the most (Ramaiah, 1985). Striga species threaten the lives of over 100 million people in Africa and it infest about 40% of arable land in the Savannah region arable land causing a loss of US$ 7 to 13 million. Similarly, As Baguma and Bigirwa (1996) estimated an economic loss of US$ 8 million a year.

The herbicidal control of Striga prior to flowering and seed set can contribute to reduction of the soil seed bank and subsequent Striga infestation. However, chemical control of striga is not widely practiced due to its high cost and the need for specialized equipment, unavailability on market, and environmental concerns by the public at large. In northern Cameron and Nigeria 2.4-D and triclopyr, Dual Gold (Metalachlor 960 EC), and Primagram have been applied at a dose of and 1 l/ha and 3 lt ha^{-1}, respectively. These herbicides reduced the number of striga emerged and increased sorghum yield (Carsky *et al*., 1994; Lagoke et al., 1994). However, Carson (1993) reported that 2.4-D was inefficient chemical for controlling the parasite in maize in Gambia. Thus, this experiment was designed to evaluate chemical herbicides which can best perform against Striga in sorghum fields of West Shoa Zone districts.

Material and Methods

The evaluation work was conducted in Jeldu, District of West Shoa Zone on naturally striga infested sorghum field. The experiment was laid out using RCBD with three replications. Treatments were application 2, 4-D on 85th days after sowing, primgram at 3 lt/ha, Dual Gold (Metalachlor 960 EC) at 3 l/ha; 2.4-D at lt/ha + Primagram at 3 lt/ ha; 2.4-D at lt/ha + Metalachlor 960 EC at 3 lt/ha, Kerosene (for seed dressing), farmer practice and weedy check. Post emergence herbicide, 2.4-D application was made on 85th day after sowing and pre-emergence herbicide Metalachlor 960 EC and Primgram was applied 1 day after sowing. Improved variety of sorghum "Alemaya ETS-2752" was used as test crop. The size of each plot was 6m x 5m with a distance of 1 m between plots and 1.5m between block were left to avoid spray drift from adjacent plot.

Data collection

Data on yield and yield component of Sorghum such as: Sorghum plant count, plant height, stock biomass, grain yield and 1000 seed weight were recorded. In addition to that data on Striga plant count per plot, Striga plant height, and biomass were collected. Analysis of variance was done using appropriate computer software.

Results and Discussion

Effect of herbicides on yield and yield components of Sorghum

Sorghum plant height, stock biomass, grain yield and thousand seed weight showed significant difference ($P<0.05$) due to herbicides (Table1). The highest mean plant height, stock biomass and grain yield were recorded from the sequential application of Metalachlor 960 EC + 2, 4-D as compared to weedy check. The highest thousand seed weight was also recorded from sequential application of Metalachlor 960 EC + 2, 4-D and 2, 4-D application. Therefore, Sequential application of Metalachlor 960 EC + 2, 4-D was effective in increasing plant height, crop biomass and grain yield as compared to other treatments. However, Sorghum plant population showed non-significant due to herbicide treatment (Table 1).

Effect of herbicides on Striga population, height and biomass

Striga population and biomass showed non-significant difference among treatments though, the highest Striga population (16333 plants/ha) was observed from the application of 2, 4-D followed by sequential application of Metalachlor 960 EC + 2, 4-D. Striga plant height showed significant difference ($P<0.05$) due to herbicides (Table2). The lowest Striga plant height (31.917 cm) was recorded from sequential application of Metalachlor 960 EC + 2, 4-D. Similarly, the lowest Striga population and biomass were recorded from sequential application of Metalachlor 960 EC + 2, 4-D though there was no significant differences among the treatments. Therefore, sequential application of Metalachlor 960 EC + 2, 4-D was reduced Striga height population and biomass as compared to other treatments.

Table1. Effect of herbicides on Sorghum plant height, population density, biomass, thousand seed weight and grain yield in Jeldu district during 2017/2018

Treatments	Plant height (cm)	Plant population /ha	Stock biomass (kg/ha)	Grain yield (kg/ha)	1000 seed weight (g)
Year 2017	236.083 ^{a}	29817 ^{b}	11067	716.8 ^{a}	24.2167 ^{a}
Year 2018	209.042 ^{b}	66967 ^{a}	9518	473.5 ^{b}	22.5125 ^{b}
LSD	13.787	6138.8	ns	204.55	1.2547
2,4-D	225.08 ^{ab}	48000	12800 ^{ab}	666.6 ^{ab}	24.383 ^{a}
Primgram	228.58 ^{ab}	50200	9933 ^{abc}	564.3 ^{ab}	23.950 ^{ab}
Metalachlor 960 EC	217.50 ^{ab}	47533	7967 ^{bc}	497.2 ^{ab}	21.617 ^{b}
Metalachlor 960 EC + 2,4-D	240.92 ^{a}	51000	13967 ^{a}	886.2 ^{a}	24.300 ^{a}
Primagram+2,4-D	222.67 ^{ab}	44067	12200 ^{ab}	609.2 ^{ab}	23.583 ^{ab}
Kerosene (for seed dressing)	227.67 ^{ab}	47667	11367 ^{ab}	674.8 ^{ab}	23.933 ^{ab}
Farmers practice	211.75 ^{b}	50667	8140 ^{bc}	510.4 ^{ab}	22.833 ^{ab}
Un treated	206.33^{b}	48000	5967 ^{c}	352.4 ^{b}	22.317 ^{ab}
LSD (0.05)	27.573	Ns	4886.5	409.11	2.5094
CV%	10.50	21.517	40.26	58.3	9.108

***Note**: Means followed by the same letter within a column are not significantly different at 0.05p; ns= non significantly different*

Table2. Effect of different herbicide on Striga plant population and height and biomass in Jaldu district, during 2017/2018

Treatments	Striga population (Number of plants /ha)	Striga plant height (cm)	Striga biomass (kg/ha)
Year 2017	23000	43.717 [a]	278 [b]
Year 2018	29742	33.119 [b]	60348 [a]
LSD	Ns	3.7304	35717
2,4-D	16333	41.700 [a]	7833
Primgram	38333	40.694 [a]	58500
Metalachlor 960 EC	32000	39.856 [a]	56193
Metalachlor 960 EC + 2,4-D	10067	31.917 b	5500
Primagram +2,4-D	28767	38.265 [ab]	30793
Kerosene (for seed dressing)	18000	38.183 [ab]	9767
Farmers practice	17000	39.246 [ab]	24073
Untreated	50467	37.480 [ab]	49847
LSD (0.05)	Ns	7.4608	ns
CV%	130.69	16.47	199.856

Note: Means followed by the same letter within a column are not significantly different at 0.05p;
ns= not significantly
Different

Conclusion and Recommendation

Significantly highest Sorghum plant height (240.9cm) and grain yield (886.2 kg/ha) were recorded from sequential application of Metalachlor 960 EC + 2, 4-D as compared to un treated check. Similarly, maximum stock sequential application of Metalachlor 960 EC + 2, 4-D as compared to other treatments. Similarly, the lowest Striga population, height and biomass were recorded from sequential application of Metalachlor 960 EC + 2, 4-D as compared to other treatments. Therefore, sequential application of Dual gold+ 2, 4-D is effective against Striga weed in sorghum. So, sequential application of Metalachlor 960 EC + 2, 4-D is recommended as one component of integrated Striga management in sorghum fields.

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