Selected technologies for sorghum protection to reduce pests losses under rainfed conditions in Gedarif State, Sudan

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Abstract

Sorghum is attacked by various field pests throughout its growth stages and has been described by different workers. Different insect pests' species were listed; Soil diseases and different weeds also recorded. The most serious is probably the central shootfly, *Atherigona soccata* (Rondani), head covered smut, *Sphacelotheca sorghi* and *Striga hermenthica.* The experiments were conducted at Northern area, Gedarif State, viz., University Farm (Twawa) during the 2010/2011 and 2011/2012 seasons. The objective of this research is to test selective technologies for reducing field pests losses on dry land sorghum. The sorghum varieties Wad Ahmed (late maturing) and Arfa Gadamak (early maturing) were sown. Gaucho 70 WS and Raxil 2 WS insecticides seed-dressings for controlling Covered smut and central shootfly control. Two selective Herbicides for controlling broad leaves weeds e.g., (2.4.D and Glean) were applied to control *Striga hermenthica* and others broad leave weeds. Hand weeding was carried out two times on for sub-plots viz., untreated control. Urea fertilizer 1N was applied during sowing time. Regular surveys were carried out weekly after crop emergence to record pest damage and insect population, where 25 plants of sorghum were randomly selected from each plot and the numbers of dead-heart caused by the larvae of *A. soccata* were assessed. Mean number of weed/m² and % weed ground cover 4 weeks after sowing also recorded. During the harvest time disease incidence and yield were recorded. Results obtained on mean number of dead heart recorded on Arfa Gadamak variety significantly different between treatments when compared with untreated control. Treatments treated with Raxil 2 WS and Gaucho 70 WS were not recorded any dead heart, disease incidence and % damage during the season. Treatment (Hand weeding + Gaucho 70 WS + Raxil 2 WS) recorded lowest % weed ground cover compared with others treatments. The highest yield was obtained by treatment (2.4.D + Glean 75 + Gaucho 70 WS + Raxil 2 WS) (3932.2 Kg/ha.)

Keywords: Sorghum, protection, Gaucho, Raxil, yield, rainfed, loss, Striga, damage, technologies and seed dressing

Introduction

Sorghum, *Sorghum biocolor* (L) Moench is widely grown in the semi-arid tropics. It ranks as the fifth crop among cereal grains worldwide. It is the major source of food for humans and for feeding animals {1}. In the Sudan

it is grown in an area of nearly 7.2 million hectares and total production of 4.1 million metric tons is obtained annually {2}.

Sorghum is grown in irrigated schemes and rainfed areas under Sudan conditions {1}. The national average yield range between 125-133 kg/hectare, which is much below the international average {3}. The crop productivity is affected by so many factors during its growth in the field and after harvest and insect pests are among the most important components influencing sorghum production particularly under rainfed conditions {1}.

Sorghum is attacked by various field pests throughout its growth stages and has been described by different workers {3}. Different insect pest species were listed; Soil diseases and different weeds also recorded {4}. The most serious is probably the central shootfly, *Atherigona soccata* (Rondani), head covered smut, *Sphacelotheca sorghi* and *Striga hermenthica* {2} .

The objective of this research is to test selective technologies for reducing Field Pests losses under climate change conditions in the rainfed sector.

Materials and Methods

The experiments were conducted at Northern area, Gedarif State, viz., University Farm (Twawa) during the 2010-2011 season. The sorghum varieties Wad Ahmed (late maturing) and Arfa Gadamak (early maturing) were sown on 25 July, 2010. Plot size was 4 (6 ridges) ×7 meter and. Sorghum seeds were treated with Gaucho 70 WS and Raxil 2 WS insecticides seed-dressings for controlling covered kernel smut and central shootfly control which was inoculated with disease spores only. Two selective herbicides for controlling broad leaves weeds e.g., (2.4.D and Glean 75 DF) were applied to control *Striga hermintheca* and others broad leave weeds. Hand weeding was carried out two times on for sub-plots viz., untreated control. Urea fertilizer 1N was applied during sowing time. The

treatments were arranged in randomized complete block design with four replications. The Cultural practices adopted were as per ARC standard.

Treatment tested:

1- Hand weeding + Gaucho 70 WS+Raxil 2 WS+ 1N
2- 2.4. D at rate of 0.53 lit./fedd.+ Gaucho 70 WS+Raxil 2 WS+ 1N
3- (2.4. D at rate of 0.53 lit./fedd.+Glean 75 DF at rate of 1g/fedd.) + Gaucho 70 WS+Raxil 2 WS+ 1N
4- Control (Unweeded and Untreated).

Regular surveys were carried out weekly after crop emergence to record pest damage and insect population, where 25 plants of sorghum were randomly selected from each plot and the numbers of dead-heart caused by the larvae of *A. soccata* were assessed. Mean number of weed/m² and % weed ground cover 4 weeks after sowing also recorded. During the harvest time disease incidence and yield were recorded.

The data was analyzed after transformation by using the software MSTAT program. ANOVA was used for significant differences of the treatments and Duncan's Multiple Range Test for mean separation.

Results and Discussions

Results obtained on table 1 showed that mean number of dead heart recorded on Arfa Gadamak variety was significantly different between treatments when compared with untreated control. Treatments 1 (Hand weeding + Gaucho 70 WS+ Raxil 2 WS+ 1N), treatment 2 (2.4. D herbicide at rate of 0.53 lit./fedd.+ Gaucho 70 WS+ Raxil 2 WS+ 1N) and 3 ((2.4. D at rate of 0.53 lit./fedd.+Glean 75 DF at rate of 1g/fedd.) + Gaucho 70 WS+Raxil 2 WS+ 1N) were not recorded any dead heart disease incidence and % damage during the season. Treatment 1 recorded lowest % weed ground cover followed by treatments 2 and 3. The highest yield was obtained by treatment

3 (1638.4 Kg/fedd.) followed by treatment 1 and 2. The lowest yield was obtained by untreated control, which was lower than treatment 2, 4.7 times.

Result obtained on table 2 showed that mean number of dead heart caused by the central shootfly on Wad Ahmed variety was significantly different between treatments compared with untreated control. Treatments 1, 2 and 3 were freely from dead heart, disease incidence, and % damage throughout the season. Treatment 1 recorded lowest % weed ground cover (1.2) followed by treatments 2 (2.3) and 3 (2.5). However, treatments 1 and 3 were recorded higher yield (1618.3 and 1591.8 Kg/Fedd), respectively, in compare with other treatments. All treatments showed excellent performance against sorghum kernel covered diseases, central shootfly damage and weeds infestation. Treated plots scored high grain yield compared with farmer's practices and untreated control (120 and 290 kg/ fedd, respectively) (Fig. 1)

Conclusion

From the results obtained above we concluded that the use of Selected Technologies for Plant Protection in compatible together may increase the yield of sorghum under rainfed conditions when compared with farmer practices and reducing of sorghum field pests losses.

Table (1) Mean number of dead heart, % damage, % disease incidence, and % weed ground cover and yield caused by field pests on Arfa Gadamak during 2010/2011 season.

Treatment	Mean No. of dead heart	%damage	%Disease incidence	%weed ground cover 4 WAS•	Yield Kg/Fedd.
1- Hand weeding + 3 ⍓	0.0 a	0.0 (0.0) a	0.0 (0.0) a	1.0 (5.74) b	1546.6 b
2- 2.4.D + 3 ⍓	0.0 a	0.0 (0.0) a	0.0 (0.0) a	1.5 (7.04) b	1376.8 c
3- (2.4.D +Glean)+ 3 ⍓	0.0 a	0.0 (0.0) a	0.0 (0.0) a	1.5 (7.04) b	1638.4 a
4- Untreated control	20.0 b	75 (60.0)b	64(53.13) b	53.0 (46.72) a	290.0 d
Mean	5.0	18.8	16.0	14.3	1212.9
S.E+	1.2	3.2	2.4	4.7	18.7
C.V.%	24	17.02	15.0	32.9	5.41

* Number between Parenthesis were transformed to Arcsine

• WAS = Week After Sowing

⍓ + 3 = Gaucho 70 WS+Raxil 2 WS+ 1N

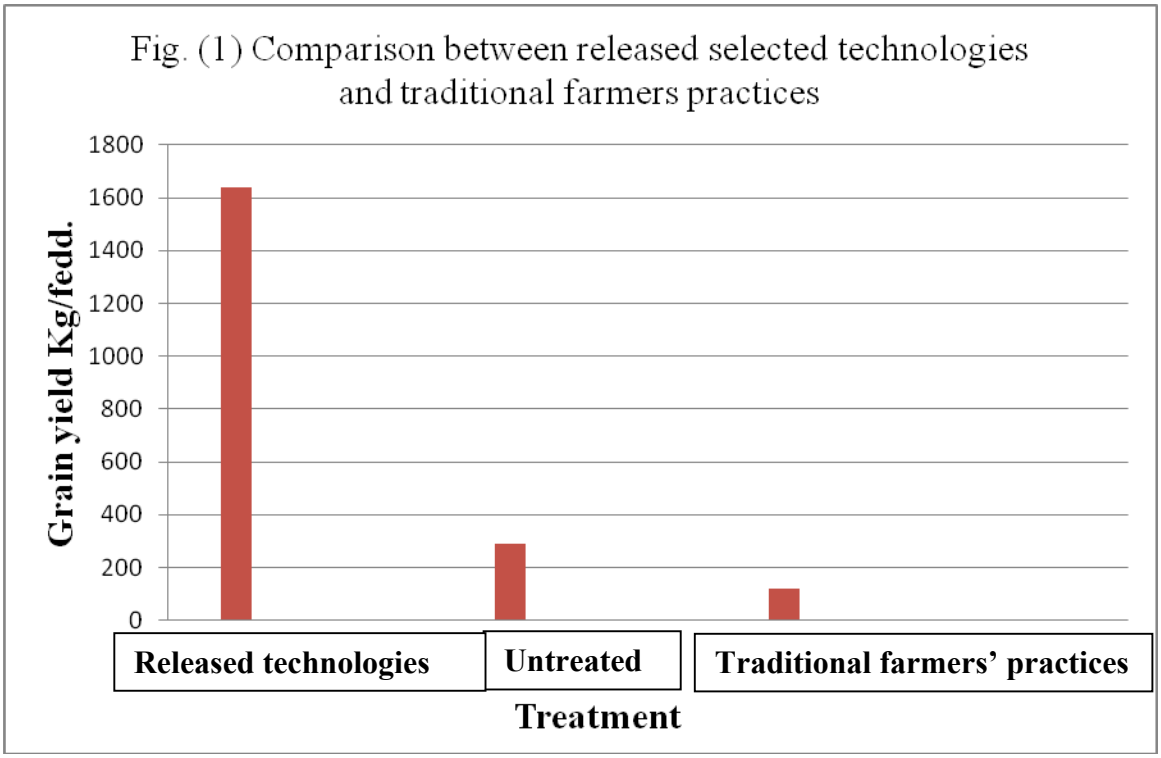
Table (2) Mean number of dead heart, % damage, % disease incidence, and % weed ground cover and yield caused by field pests on Wad Ahmed during 2010/2011 season.

Treatment	Mean No. of dead heart	%damage	%Disease incidence	%weed ground cover 4 WAS•	Yield Kg/Fedd.
1- Hand weeding + 3 ⇑	0.0 a	0.0 (0.0) a	0.0 (0.0) a	1.2 (6.02) b	1618.3 a
2- 2.4.D + 3 ⇑	0.0 a	0.0 (0.0) a	0.0 (0.0) a	2.3 (8.53) b	1213.6 b
3- (2.4.D +Glean)+ 3 ⇑	0.0 a	0.0 (0.0) a	0.0 (0.0) a	2.5 (9.10) b	1591.8 a
4- Untreated control	36.0 b	62 (51.94)b	45(42.13) b	66.0 (54.33) a	197.5 c
Mean	12.0	15.5	11.3	16.5	1155.3
S.E±	2.1	2.6	1.6	3.7	15.7
C.V.%	17.5	16.7	14.2	22.4	13.5

* Number between Parenthesis were transformed to Arcsine

• WAS = Week After Sowing

⇑ + 3 = Gaucho 70 WS+Raxil 2 WS+ 1N



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References

1- Suliman, E H, Salman, H A, Mohamed, E I, Salih, S A, Ali, A E, Adam, M H M Hassan, M K, Mohamed, A H, Elnour, O A and Kannan, H O (2015). Screening of some sorghum genotypes for resistance to sorghum midge, *Stenodiplosis= (Contarinia) sorghicola* Coqillet (Diptera: Cecidomyiidae) under Gedarif rainfed conditions. Journal of Basic and Applied Research International.2015; 2(4) 150-156.

2- Suliman, E. H., Salman, H.A., Mohamed, E. I., Salih, S. A., Al, i E. A, Mohamed, A. H., Sharma, H. C. and Bashir, N. H. H. (2015). Resistance of a selected sorghum genotypes (Sorghum bicolor (L.) Moench) to central shootfly, Atherigona socatta (Rondani) under Gedarif Rainfed conditions. The 90th Meeting of the National Pests and Diseases Committee, Agric. Res. Corporation, June 2014, Wad Medani, Sudan

3- Suliman, E H and Nabil H. H. Bashir (2014). Studies on central shootfly, *Atherigona socatta* (Rondani) resistance in sorghum (Sorghum bicolor (L.) Moench) under Gedarif Rainfed conditions. Proccedings of 3rd. Conference of Pests Mamagement in the Sudan, 3-4, 2014. p 168.

4- Suliman;EH, Yassin E. Hassan; Mohamed H. Mohamed; Hanan A. Sulman; Mohamed K.Hassan; Ali E. Ali and H.C. Sharma (2009). Evaluation of resistant sorghum genotypes to sorghum midge, *Contarinia sorghicola* Coquillet (Cecidomyidae: Diptera), resistance under Sudan rainfed conditions.Sudan Journal of Agricultural Research. Vol. 14, 2009.pp. 61-68.