ACTA SCIENTIFIC AGRICULTURE (ISSN: 2581-365X)

Volume 3 Issue 5 May 2019

Research Article

Effect of Early Post Emergent Herbicides and Herbicide Mixtures on Soil Dehydrogenase Activity and Grain Yield of Maize (*Zea mays* L)

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Received: February 12, 2019; **Published:** April 12, 2019

Abstract

A field experiment was conducted during kharif (rainy season) 2014 at Dharwad to evaluate the effect of early post-emergent herbicides and herbicide mixtures on soil dehydrogenase activity and grain yield in maize. Results indicated that the dehydrogenase activity was significantly reduced with atrazine and 2,4-D when used alone and it was higher with i.e. herbicide mixture topramezone 12.5 g/ha+atrazine 625g/ha at 7 and 15 DAS after herbicide application which also recorded higher grain yield.

Keywords: Maize; Early Post Emergent Herbicides; Herbicide Mixtures; Grain Yield Dehydrogenase Activity

Introduction

Maize is the world's third most cereal crop after wheat and rice. In India, maize is grown in an area of 8.78 m ha with a production of 21.76 m t. The average productivity of maize in India is 2478 kg ha^{-1} as against the world average of 4860 kg ha^{-1} [1]. Maize, being a rainy season and widely spaced crop, gets infested with variety of weeds and subjected to heavy weed competition, which often inflicts huge losses ranging from 28 to 100 per cent [2]. Weed management with early post-emergent herbicide may become a viable alternative to the current methods of weed control in view of labour scarcity at the time of sowing. To have broad spectrum weed control, we may have to mix two herbicides having effectiveness against different weed flora. In doing so, their effect on soil dehydrogenase activity should not be ignored. Hence, a field trial was conducted to study the effect of early post emergent herbicides/herbicides mixtures on soil dehydrogenase activity and grain yield of maize.

Material and Methods

A field experiment was conducted at Main Agricultural Research Station, Dharwad, Karnataka, India during rainy season of 2014. The soil of experimental site was black clayey (Vertisols). The experiment was laid out in RCBD with three replications involving 8 treatments. The treatment details are given in Table 1. Maize hybrid 900-M Gold was sown at 60 cm X 20 cm and recommended dose of fertilizers was applied as per package of practices. The soil dehydrogenase activity was studied at 7 and 15 DAS after application herbicides and grain yield per ha was recorded.

Results and Discussion

After 7 DAS, significantly higher dehydrogenase activity was observed in application of tank-mixtures *viz.,* topramezone 12.5 g/ha + atrazine 625 g/ha and topramezone 12.5 g/ha + 2,4-D Na salt 500 g/ha (3.92 and 3.80 µg TPF/g soil/day, respectively) which was on par with weed free treatment (4.25 µg TPF/g soil/day). In weedy check dehydrogenase activity was significantly higher (5.27 µg TPF/g soil/day). The lowest dehydrogenase activity was recorded in atrazine @ 1.25 kg ha^{-1} (1.60 µg TPF/g soil/day) which was significantly lower compared to all other treatments (Table 1).

Treatments	Grain yield (kg/ha)	Dehydrogenase activity	
		7 DAS	15 DAS
T_1 - Topramezone 25 g/ha at 20 DAS (Early Post-emergence)	5707	3.01	3.35
T_2 - Atrazine 1.25 kg/ha at 20 DAS (Early Post-emergence)	5713	1.60	2.22
T_3 - 2, 4-D Na salt 1.0 kg/ha at 20 DAS (Early Post-emergence)	5604	2.81	2.11
T_4- Topramezone 12.5 g/ha + atrazine 625 g/ha at 20 DAS (Early Post-emergence) (Tank mixture)	6791	3.92	4.17
T_5 - Topramezone 12.5 g/ha + 2, 4-D Na salt 500 g/ha at 20 DAS (Early Post-emergence) (Tank mixture)	6609	3.80	3.81
T_6 - Atrazine (PRE) 1.25 kg/ha + IC+ HW (RPP)	6882	2.61	3.04
T_7 - Weed free	7103	4.25	4.59
T_8 - Weedy check	4973	5.27	5.69
S. Em.±	278	0.33	0.28
C.D. (0.05)	842	1.00	0.86

Table 1: Soil dehydrogenase activity (µg TPF/g soil/day) and grain yield (kg/ha) as influenced by early post emergent herbicides in maize.

PRE- Pre-emergent, IC- Intercultivation, HW- Hand Weeding, RPP- Recommended Package of Practice

After 15 DAS, application of tank-mixtures topramezone 12.5 g/ha + atrazine 625 g/ha and topramezone 12.5 g/ha + 2,4-D Na salt 500 g/ha (4.17 and 3.81 µg TPF/g soil/day, respectively) recorded significantly higher dehydrogenase activity which was on par weed free check. The values were significantly higher with weedy check also (5.69 µg TPF/g soil/day). The lower dehydrogenase activity was recorded in 2,4-D 1.0 kg/ha^{-1} (2.11 µg TPF/g soil/day) and atrazine @ 1.25 kg ha^{-1} (2.22 µg TPF/g soil/day) compared to all other treatments. The reduced soil enzyme activity may be due to the reduction in the soil microbial activities in rhizosphere [3,4]. This was due to higher dose of herbicide when used alone, while the dose was less in herbicide mixtures.

Grain yield was significantly higher with the application of the herbicide tank-mixtures *viz.,* topramezone 12.5 g/ha + atrazine 625 g/ha and topramezone 12.5 g/ha +2,4-D 500 g/ha (6791 kg/ha and 6609 kg/ha, respectively) compared to their single applications. More interestingly, these herbicide mixtures were on par with recommended weed management practice and with weed free treatment. Weed free check (7103 kg/ha), recommended weed management practice (6882 kg/ha), topramezone 12.5 g/ha + atrazine 625 g/ha (Rs.97259/ha) recorded significantly higher net returns and they were on par with each other. This result is in conformity with the findings of Walia., *et al* [3].

Conclusion

From the foregoing, it can be concluded that topramezone 12.5 g/ha + atrazine 625 g/ha resulted in higher dehydrogenase activity and grain yield compared to single application of herbicide.

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