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Optimum Rice Density and Herbicide Application in Direct Seeding in Ahwaz Region, Iran

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Abstract: In order to investigate of rice and barnyard-grass in different levels of herbicide and crop density, an experiment was conducted in split plot design with four replicate, in research farm of Ramin Agriculture and Natural Resources University in 2006. Four herbicide doses (0, 3, 5 and 7 L ha^{-1}) was arranged in main plots and three seeding rates (100, 120 and 140 kg seed ha^{-1}) in subplots. Interaction of herbicide and crop density on dry matter and yield of rice and barnyard-grass was significant. Therefore, response of variance trends of these traits to herbicide in different densities was different. While no herbicide was be used, rice yield in density 120 was higher than other densities, that showed that optimum crop density could increased crop competition ability and decreased herbicide use. In other hand, it be observed that highest and lowest yield of crop and weed, respectively, was be related to 5 L herbicide ha^{-1}. In this case, there was little difference between different densities. With more herbicide use, probably due to toxicity effect, crop yield decreased. However, in this herbicide dose, density 120 showed lesser changes in crop yield. In density 120, crop and weed yield relationship have lesser slope in comparison with other densities. Ultimately, it seems that optimum crop density can lessen crop sensitivity to other enviroumental and agronomic factors including weed competition and herbicide use.

Key words: Barnyard-grass, crop density, direct seeding, herbicide, rice, yield

INTRODUCTION

Among common weeds, barnyard-grass (*Echinocloa crus-galli*) has the most abundance and economic importance in rice fields. With regarding to worker deficit and increasing fees, chemical method is most simple and cheap method to control weeds. However, most researches are conducting to reduce herbicide use through increase crop competition ability (Kim *et al*., 2006). Many efforts have been made to investigate the effects of reduced doses of herbicide on crop-weed competition in cereal crops, such as spring barley (Christensen, 1994), winter wheat (Brain *et al*., 1999) and spring wheat (Salsonen, 1992). Studies on reduced doses of herbicide have also been conjunction with various cultural practices, such as seeding rate and crop density (Shibayama, 2001). Crop density has a key role in weed management. Optimum crop density result in rapid shading on soil surface and prevent weed growth (Radosevich *et al*., 1997). However, Kevin *et al*. (2001) indicated that different rice densities in direct seeding have no significant effect on barnyard-grass growth. Transplanted rice seedlings, especially larger ones, are much more competitive with weeds than direct-seeded plants (Shibayama, 2001).

Regulations for protecting enviroument from pollution from agriculture have encouraged farmers to use less inorganic input including herbicides. Kevin *et al*. (2001) showed that use 4.5 L molinit ha^{-1} in flooding direct rice seeding, decreased Dry Matter (DM) and tillering of barnyard-grass, significantly. In other hand, Lesnik (2003) indicated that herbicide use efficiency increased by

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optimum crop density in maize. The objective of this study was evaluation interaction of herbicide and seeding density of rice to reduce herbicide use through optimum density.

MATERIALS AND METHODS

An experiment was carried out in 2006 at Ramin Agriculture and Natural resources University, Ahwaz, Iran. The experimental design was split plot in RCB with four replications. Four herbicide doses (0, 3, 5 and 7 L molinit ha^{-1}) were arranged in main plots and three rice seeding rates (100, 120 and 140 kg seed ha^{-1}) were arranged in sub plots. Cultivar LD183 (late maturing cultivar) was be used in this experiment. In order to have monotony and to have 40 barnyard-grass shrubs per squared meter, 4.8 g seed of this weed was spread in plots. Rice seeds were spread monotony and directly in plots. Statistical Analysis Systems (SAS) and excel software were be used to analysis data of experiment. Because of significant interaction between factors, main effect of each factor was not be evaluated. Finally, regression analysis was carried out for data (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

DM and GY of Crop and Weed

Results showed that seeding density and herbicide had significant effects on rice and barnyard-grass dry matter, DM and grain yield, GY (Table 1).

With increase herbicide use up to 5 L ha^{-1}, DM of rice increased significantly (Fig. 1). Herbicide use more than 5 L ha^{-1} up to 7 L ha^{-1}, result in decrease rice DM in 100 and 140 kg seed ha^{-1}, but had

Table 1: Analysis of variance of GY and DM in rice and barnyard grass

		Mean squared			
SOV	df	DM of rice	DM of weed	GY of rice	GY of weed
Block	3	899.62	550.76	18889.29	732.81
Herbicide (H)	3	1517758.19**	300774.16**	97281.16**	57778.14**
Ea	9	54235.89	3498.41	13459.40	1155.37
Density (D)	2	270252.46**	31099.01**	262494.36**	11505.61**
H*D	6	114643.76**	11916.84**	11916.84**	132399.95**
Eb	23	23484.59	1721.41	5681.58	513.74
CV (%)	-	9.14	7.8	27.28	29.54

**Significant µm 1 (%) probability

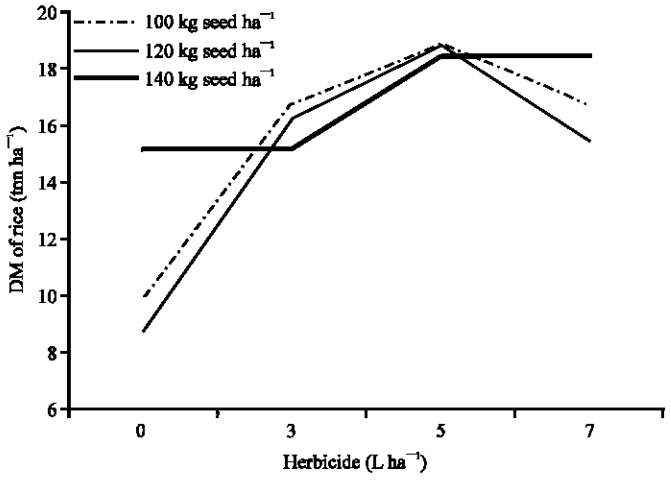

Fig. 1: Effect of herbicide and seeding rate on DM of rice

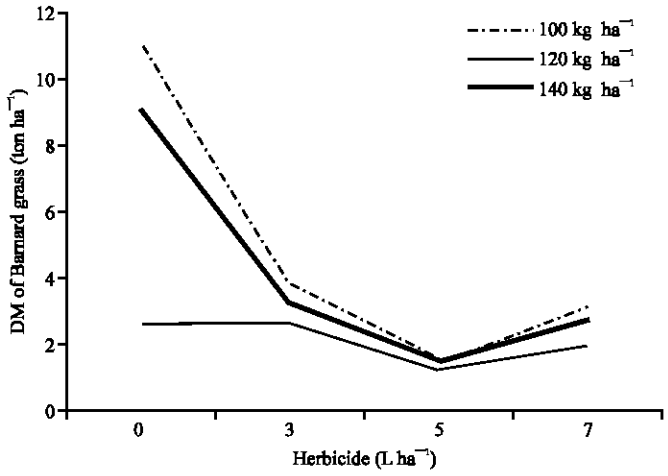

Fig. 2: Effect of herbicide and seeding rate on DM barntard-grass

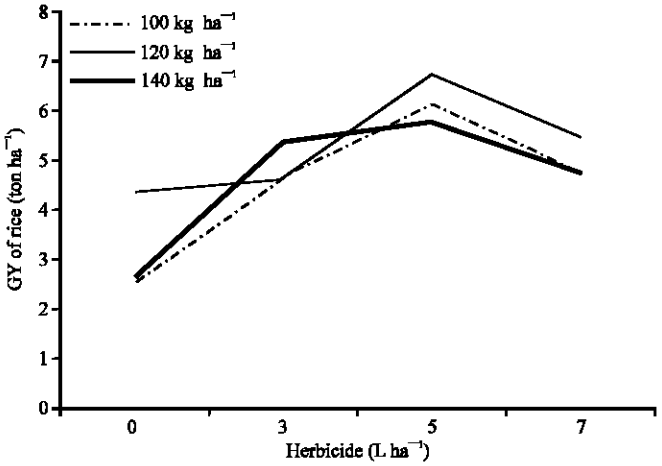

Fig. 3: Effect of herbicide and seeding rate on GY of rice

no effect on DM in density 120 kg seed ha^{-1}. Also, while no herbicide was be used, rice DM in density 120 was higher than two other densities. Generally, herbicide effect on DM was lower in density 120 in comparison with other densities.

In other hand, DM of barnyard-grass while no herbicide applied, in density 120 was lower than other densities, significantly (Fig. 2). With increase herbicide, DM of barnyard-grass decreased earlier in densities 100 and 140, in comparison with density 120 kg seed ha^{-1}. However, in all herbicide doses, DM of barnyard-grass was lowest in density 120 kg seed ha^{-1}. It seems that in optimum crop density, lesser herbicide will be required (Lesnik, 2003).

The GY of rice in density 120, while no herbicide applied, was higher than two other densities (Fig. 3). With increase herbicide up to 5 L ha^{-1}, GY increased in all densities. However, application herbicide up to 7 L ha^{-1} could not increase competition ability and GY of rice. It is probably due to rice shrubs toxicity. Highest GY of rice was gained with 5 L herbicide ha^{-1} and 120 kg seed ha^{-1}. The GY of barnyard-grass with no herbicide in density 120 was lower than other densities, significantly (Fig. 4). It showed that weeds will be controlled better in optimum crop density. With herbicide

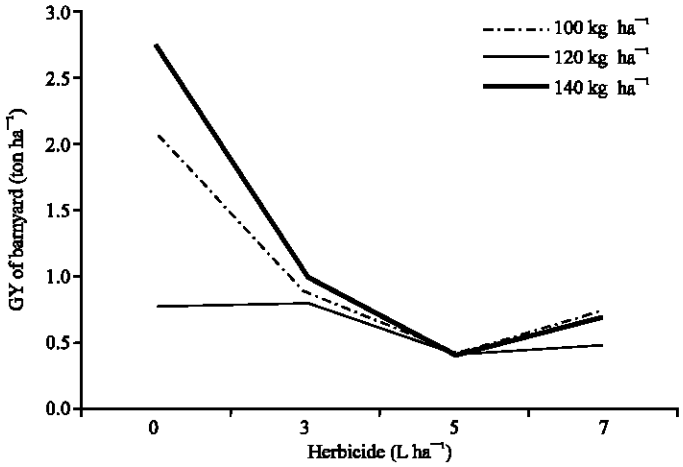

Fig. 4: Effect of herbicide and seeding rate on GY of barnyard-grass

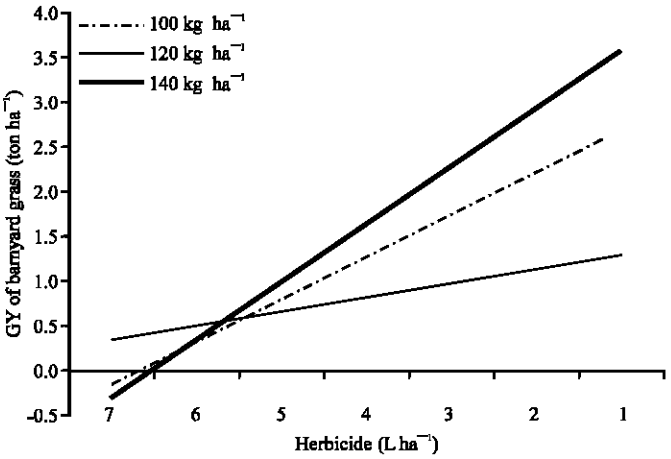

Fig. 5: Relationship between GY of Rice and barnyard-grass in different seeding rate

application, GY of barnyard-grass decreased significantly, in densities 100 and 140 seed ha^{-1}, that show higher demand to herbicide in these densities.

Crop and Weed Yield Relationship

Regression analysis showed that with increase GY of barnyard-grass, GY of rice decrease linearly (Fig. 5). It was expected, but this trend in densities 100 and 140 kg seed ha^{-1} was severe in comparison with density 120 kg seed ha^{-1}.

CONCLUSION

With increase herbicide dose, weed could be controlled, significantly. But exceeded dose of herbicide, can be also toxic for crop. In addition, it is possible that a reduced herbicide dose will be adequate for weed control while seeding rate is optimum.

It seems that in density 120, weeds could be more controlled than other densities and a better nutritive space will be provided for rice. These conditions can be helpful for crop in competition in barnyard-grass.

Ultimately, it seems that optimum seeding rate as a good crop density can decrease crop sensitivity to weed competition and herbicide use.

These finding showed that integrated weed control procedures could be helpful in direct seeding of rice to maximizing rice yield with reduced herbicide those.

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