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Correlation and Regression Analysis of *rabi* Maize - Weed Ecosystem

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Abstract

A field experiment was conducted at AICRP - WM, B. A. College of Agriculture, Anand Agricultural University, Anand during *rabi* 2019-20 and 2020-21 in lomy sand soils to study the correlation of the grain yield of maize on certain weed and crop parameters in middle Gujarat conditions. The experiment consisted ten treatments laid out in a randomized block design with three replications. After harvest, correlation and regression analysis were studied between grain yield as the dependent variable and each of the following traits as independent variables (Monocot weed density (no/m^2) at 25, 50 DAS and at harvest, Dicot weed density (no/m^2) at 25, 50 DAS and at harvest, Total weed density (no/m^2) at 25, 50 DAS and at harvest, Monocot weed dry biomass (g/m^2) at 25, 50 DAS and at harvest, Dicot weed dry biomass (g/m^2) at 25, 50 DAS and at harvest, Total weed dry biomass (g/m^2) at 25, 50 DAS and at harvest, Weed control efficiency at 25, 50 DAS and at harvest, Straw yield, Plant stand at 30 DAS and at harvest and Plant height at 30 DAS, 60 DAS and at harvest) The results revealed that grain yield was highly negatively correlated with density and dry biomass of weeds at 25and 50 DAS as well as at harvest in pooled analysis, while non-significant positive correlation was observed with weed control efficiency at 25 and 50 DAS but, highly significant positive correlation was found with weed control efficiency at harvest in pooled analysis. The correlation coefficient between grain yield and periodical plant height, straw yield and plant stand at harvest were highly significant positive correlation in pooled analysis, while plant stand at 30 DAS showed non-significant positive correlation.

As regards the predictions pertaining the reduction in grain yield due to monocot weed density, dicot weed density and total weeds density, it was in the order of 0.0079, 0.0104, 0.0046 t/ha at 25 DAS, 0.0148, 0.0296, 0.0101 t/ha at 50 DAS and 0.0389, 0.0503, 0.0259 t/ha at harvest for monocot weeds density, dicot density weeds and total weeds density respectively in pooled analysis. Prediction pertaining the reduction in grain yield due to monocot weed dry biomass, dicot weed dry biomass and total dry weed biomass, it was in the order of 0.0231, 0.0501, 0.0161 t/ha at 25 DAS, 0.0124, 0.0259, 0.0083 t/ha at 50 DAS and 0.0121, 0.0182 0.0076 t/ha at harvest for monocot weeds dry biomass, dicot weeds dry biomass and total weeds dry biomass respectively in pooled analysis. The prediction pertaining the increase in grain yield due to weed control efficiency at 25 DAS, 50 DAS and harvest, it was in the order of

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0.0093, 0.0237, 0.0187 t/ha respectively for weed control efficiency at 25 DAS, 50 DAS and harvest in pooled analysis.

Key words: Correlation, Regression, Herbicide, Weeds

INTRODUCTION

Maize (*Zea mays* L.) is believed to be originated from Mexico and Central America. Maize is the most important component of food security at global level. In India, maize is the third most important food crop after rice and wheat. In India, it is cultivated in an area of 8.67 M ha with a productivity of 2.57 t/ha. In Gujarat, it is cultivated in 0.46 M ha with a productivity of 1.72 t/ha (Anonymous, 2016-17). Area under *Rabi* maize is increasing with the introduction of new hybrid varieties. *Celosia argentea* is found to be a severe problem in middle Gujarat, North Gujarat and some part of Saurashtra region in maize.eed infestation is a potential problem to realize higher yield of maize around the globe as well as in south Asia. Weeds not only decrease crop yield but also harbor insects, pests and diseases. In some cases, they serve as an alternate host for these pests (Letourneau, 2011). In organic farming, the weeds are managed by applying mulches, cultural, physical, mechanical and chemical methods as components of integrated weed management (IWM) that helps to promote crop yield (Karlen, 2007). Weed must be properly managed to avoid economic losses in crop production. Initial 6 weeks after sowing (WAS) are found very susceptible to weed infestation in maize, significantly decreasing final grain yield (Das *et al.*, 2016).

Chemical method of weeding is very easy, flexible and cheaper than using costly labors for weeding purpose. Furthermore, this method is very useful in different climatic and edaphic conditions and shows effective results compared to tedious manual method of weeding. Both by increasing herbicide use efficiency and reducing injury to crop by applying recommended doses, an individual can improve his economy maximizing yield of crop reducing weed infestation easily by chemical method (Sutton *et al.*, 2002). Swetha *et al.* (2015) reported that tank-mix application of post-emergence herbicides topramezone (22.5 g/ha) or tembotrione (105 g/ha) with lower dose of atrazine at 250 g/ha were found effectively for weed control and increase grain yield with high B:C ratio in *Kharif* maize. For weed control and management of maize crop, Atrazine (2 – chloro –4 – ethylamino – 6 - isopropylamino - 1,3,5 - triazine) and 4 hydroxyphenylpyruvate dioxygenase (HPPD) inhibiting herbicide which can also control Glyphosate resistant weeds like Amaranthus palmeri are generally used (Sutton *et al.*, 2002; Swanton *et al.*, 2007; Vyn *et al.*, 2006). Walsh *et al.* (2012) concluded that Atrazine can be used as both pre and post emergence herbicide and can be applied solely or mixing with other herbicides too. The broad spectrum weed control ability can be applied in different plant growth stages, easily used by mixing with other herbicides, relatively safe to crop plants etc. have made HPPD- inhibiting herbicide commonly used in maize field (Walsh *et al*., 2012; Bollman *et al*., 2008; Stephenson and Bond, 2012).

The present study was conducted to estimate the correlation between studied traits, and to predict their effect on grain yield through regression analysis, and to determine their direct and indirect effects on grain yield.

MATERIALS AND METHODS:

Field experiments were conducted at the AICRP weed management project farm, Department of Agronomy, Anand Agricultural university, Anand. The soil of the experimental field is loamy sand in texture with low in available nitrogen, medium in available phosphorus, high in available potassium and low in available sulphur. The experiment comprising of ten treatments viz., (T1), Atrazine 50% WP 1000 g a.i./ha PE *fb* IC at 30 DAS, (T2), Pendimethalin 30% EC1000 g a.i./ha PE *fb* IC at 30 DAS, (T3), Atrazine 50% WP + Pendimethalin 30% EC (500 +250 g a.i./ha) PE (Tank mix), (T4), Topramezone 336 g/l w/v SC 25.2 g a.i./ha EPE *fb* IC + HW at 40 DAS, (T5), Topramezone 336 g/l w/v SC + atrazine 50% WP (25.2 + 500 g a.i./ha) EPoE(Tank mix), (T6), Tembotrione 34.4% SC120 g a.i./ha EPoE*fb* IC + HW at 40 DAS, (T7), Tembotrione 34.4% SC + atrazine 50% WP (120 + 500 g a.i./ha) EPoE(Tank mix), (T8), IC at 20 and 40 DAS, (T9), IC + HW at 20 and 40 DAS and (T10), Weedy check.The trial was laid out in a randomized block design with three replication plot size was 3.6 x 5 m for crop seed rate is 20 kg ha^{-1} (Maize GAYMH 3). Fertilizers were applied 150-60-0 NPK kg/ha, Nitroge was allpied in 4 equal split at basal, 4 leaf stage, 8 leaf stage & at tasseling stage. First year experiment sown on dated 11/11/2019 and in second year experiment sown on dated 30/11/2020. All the agronomic practices were carried out uniformly to raise the crop.

RESULT AND DISCUSION

Table 1: Correlation of maize yield on weed characters

Dependent variables	Characters	Correlation coefficient (r)		
		2019-20	2020-21	Pooled
Seed yield (Kg/ha)	Monocot weed density (no/m^2) at 25 DAS	-0.808**	-0.877**	-0.915**
	Dicot weed density (no/m^2) at 25 DAS	-0.717*	-0.875**	-0.820**
	Total weed density (no/m^2) at 25 DAS	-0.771**	-0.873**	-0.887**
	Monocot weed density (no/m^2) at 50 DAS	-0.853**	-0.910**	-0.959**
	Dicot weed density (no/m^2) at 50 DAS	-0.799**	-0.907**	-0.960**
	Total weed density (no/m^2) at 50 DAS	-0.851**	-0.929**	-0.973**
	Monocot weed density (no/m^2) at harvest	-0.881**	-0.642*	-0.857**

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	Dicot weed density (no/m^2) at harvest	-0.517^{NS}	-0.637*	-0.735*
	Total weed density (no/m^2) at harvest	-0.826**	-0.732*	-0.875**
	Monocot weed dry biomass (g/m^2) at 25 DAS	-0.801**	-0.880**	-0.920**
	Dicot weed dry biomass (g/m^2) at 25 DAS	-0.714*	-0.761**	-0.836**
	Total weed dry biomass (g/m^2) at 25 DAS	-0.775**	-0.864**	-0.903**
	Monocot weed dry biomass (g/m^2) at 50 DAS	-0.842**	-0.912**	-0.957**
	Dicot weed dry biomass (g/m^2) at 50 DAS	-0.802**	-0.934**	-0.956**
	Total weed dry biomass (g/m^2) at 50 DAS	-0.840**	-0.953**	-0.975**
	Monocot weed dry biomass (g/m^2) at harvest	-0.970**	-0.817**	-0.894**
	Dicott weed dry biomass (g/m^2) at harvest	-0.933**	-0.858**	-0.911**
	Total weed dry biomass (g/m^2) at harvest	-0.983**	-0.859**	-0.923**
	Weed control efficiency at 25 DAS			0.204^{NS}
	Weed control efficiency at 50 DAS			0.619^{NS}
	Weed control efficiency at harvest			0.894**

Table 2: Regression of maize yield on weed characters

Dependent variables	**Characters**	**Y = a + bX**		
		2019-20	**2020-21**	**Pooled**
Seed yield (Kg/ha)	Monocot weed density (no/m^2) at 25 DAS	$7.791-0.008x_{1}$	$8.632-0.0081x_{1}$	$8.210-0.0079x_{1}$
	Dicot weed density (no/m^2) at 25 DAS	$7.727-0.0076x_{2}$	$8.650-0.0148x_{2}$	$8.198-0.0104x_{2}$
	Total weed density (no/m^2) at 25 DAS	$7.762-0.0040x_{3}$	$8.693-0.0072x_{3}$	$8.211-0.0046x_{3}$
	Monocot weed density (no/m^2) at 50 DAS	$7.802-0.0130x_{4}$	$8.743-0.0231x_{4}$	$8.236-0.0148x_{4}$
	Dicot weed density (no/m^2) at 50 DAS	$7.790-0.0212x_{5}$	$8.745-0.0384x_{5}$	$8.261-0.0296x_{5}$
	Total weed density (no/m^2) at 50 DAS	$7.807-0.0086x_{6}$	$8.759-0.0150x_{6}$	$8.252-0.0101x_{6}$
	Monocot weed density (no/m^2) at harvest	$8.060-0.0291x_{7}$	$8.925-0.0338x_{7}$	**$8.595-0.0398X_{7}$**
	Dicot weed density (no/m^2) at harvest	$8.209-0.0219x_{8}$	$9.599-0.0430x_{8}$	**$9.057-0.0503x_{8}$**
	Total weed density (no/m^2) at harvest	$8.373-0.0175x_{9}$	$9.487-0.0248x_{9}$	$8.943-0.0259x_{9}$
	Monocot weed dry biomass (g/m^2) at 25 DAS	$7.753-0.0184x_{10}$	$8.633-0.0274X_{10}$	$8.195-0.0231X_{10}$
	Dicott weed dry biomass (g/m^2) at 25 DAS	$7.728-0.0317x_{11}$	$8.684-0.0697X_{11}$	**$8.206-0.0501X_{11}$**
	Total weed dry biomass (g/m^2) at 25 DAS	$7.746-0.0118x_{12}$	$8.658-0.0204X_{12}$	$8.203-0.0161X_{12}$
	Monocot weed dry biomass (g/m^2) at 50 DAS	$7.779-0.0081x_{13}$	$8.683-0.0159X_{13}$	$8.222-0.0124X_{13}$
	Dicot weed dry biomass (g/m^2) at 50 DAS	$7.778-0.0156X_{14}$	$8.773-0.0381X_{14}$	$8.276-0.0259X_{14}$
	Total weed dry biomass (g/m^2) at 50 DAS	$7.784-0.0054X_{15}$	$8.736-0.0121X_{15}$	$8.257-0.0083X_{15}$
	Monocot weed dry biomass (g/m^2) at harvest	$8.048-0.0084X_{16}$	$9.024-0.0192X_{16}$	$8.156-0.0121X_{16}$
	Dicot weed dry biomass (g/m^2) at harvest	$8.467-0.0119X_{17}$	$9.396-0.0312X_{17}$	$8.953-0.0182X_{17}$
	Total weed dry biomass (g/m^2) at at harvest	$8.260-0.0052X_{18}$	$9.217-0.0126X_{18}$	$8.728-0.0076X_{18}$

	Weed control efficiency at 25 DAS			$6.803+0.0093X_{19}$
	Weed control efficiency at 50 DAS			$5.507+0.0237X_{20}$
	Weed control efficiency at harvest			$6.459+0.0187X_{21}$

Table 3: Correlation of maize yield on weed characters

Dependent variables	Characters	Correlation coefficient (r)		
		2019-20	2020-21	Pooled
Seed yield (Kg/ha)	Straw yield kg/ha	0.855^{**}	0.784^{**}	0.858^{**}
	Plant stand at 30 DAS	-0.211_{NS}	0.737^{*}	0.326_{NS}
	Plant stand at harvest	0.565_{NS}	0.754^{*}	0.817^{**}
	Plant height at 30 DAS	0.755^{*}	0.406_{NS}	0.836^{**}
	Plant height at 60 DAS	0.845^{**}	0.871**	0.950^{**}
	Plant height at harvest	0.798^{**}	0.662_{NS}	0.906^{**}

Table 4: Regression of maize yield on weed characters

Dependent variables	Characters	Y = a + bX		
		2019-20	2020-21	Pooled
Seed yield (Kg/ha)	Straw yield kg/ha	$2.066+0.656X_1$	$-2.165+1.079X_1$	$-0.3600+0.918X_1$
	Plant stand at 30 DAS	$19.150-0.145X_2$	$-67.49+0.9160X_2$	$-19.03+0.332X_2$
	Plant stand at harvest	$-20.71+0.359X_3$	$-55.81+0.7810X_3$	$-48.94+0.7080X_3$
	Plant height at 30 DAS	$0.960+0.069X_4$	$-1.006+0.1060X_4$	$-5.086+0.1430X_4$
	Plant height at 60 DAS	$-1.958+0.040X_5$	$-4.327+0.0600X_5$	$-4.138+0.0540X_5$
	Plant height at harvest	$-1.697+0.0399X_6$	$-7.089+0.0690X_6$	$-6.013+0.0610X_6$

Correlation coefficient and regression equation were worked out between seed yield and Monocot weed density (no/m^2) at 25 DAS, Dicot weed density (no/m^2) at 25 DAS, Total weed density (no/m^2) at 25 DAS, Monocot weed density (no/m^2) at 50 DAS, Dicot weed density (no/m^2) at 50 DAS, Total weed density (no/m^2) at 50 DAS, Monocot weed density (no/m^2) at harvest, Dicot weed density (no/m^2) at harvest, Total weed density (no/m^2) at harvest, Monocot weed dry biomass (g/m^2) at 25 DAS, Dicott weed dry biomass (g/m^2) at 25 DAS, Total weed dry biomass (g/m^2) at 25 DAS, Monocot weed dry biomass (g/m^2) at 50 DAS, Dicott weed dry biomass (g/m^2) at 50 DAS, Total weed dry biomass (g/m^2) at 50 DAS, Monocot weed dry biomass (g/m^2) at harvest, Dicot weed dry biomass (g/m^2) at harvest, Total weed dry biomass (g/m^2) at harvest. The result of correlation coefficients presented in Table1 revealed that seed yield was significantly and highly negative correlated with Monocot weed density (no/m^2), Dicot weed density and total weeds density, it was in the order of ((r = -0.808, r= -0.877, r=-0.915, r = -0.717, r = -0.875, r= -0.820, r= -0.771, r= -0.873 and r= -0.887) at 25 DAS during 2019-20, 2020-21 and pooled analysis respectively.

The result of correlation coefficients presented in Table1 revealed that seed yield was significantly and highly negative correlated with Monocot weeds density (no/m^2), Dicot weeds density and total weeds density, it was in the order of ((r = -0.853, r= -0.910, r=-0.959, r = -0.799, r = -0.907, r= -0.960, r= -0.851, r= -0.929 and r= -0.973) at 50 DAS during 2019-20, 2020-21 and pooled analysis respectively.

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The result of correlation coefficients presented in Table1 revealed that seed yield was significantly and highly negative correlated with Monocot weeds density (no/m^2), (r = -0.881, r=-0.857) in 2019-20 and in pooled analysis respectively, where as monocot weeds density significantly negative correlate (r= -0.642) at harvest during 2020-21. The result of correlation coefficients presented in Table1 revealed that seed yield was significantly negative correlated with dicot weeds density (no/m^2), (r = -0.637, r=-0.735) at harvest during 2020-21 and in pooled analysis respectively, where as dict weeds density non significant negative correlate (r= -0.517) at harvest during 2019-20. The result of correlation coefficients presented in Table1 revealed that seed yield was significantly and highly negative correlated with total weeds density, (r= -0826, r= -0.732 and r= -0.875) at harvest during 2019-20, 2020-21 and pooled analysis respectively.

The result of correlation coefficients presented in Table1 revealed that seed yield was significantly and highly negative correlated with Monocot weedsdry biomass (g/m^2), Dicot weed dry biomass and total weeds dry biomass, it was in the order of ((r = -0.801, r= -0.880, r=-0.920, r = -0.714, r = -0.761, r= -0.836, r= -0.775, r= -0.864 and r= -0.903) at 25 DAS during 2019-20, 2020-21 and pooled analysis respectively.

The result of correlation coefficients presented in Table1 revealed that seed yield was significantly and highly negative correlated with Monocot weeds dry biomass (g/m^2), Dicot weed dry biomass and total weeds dry biomass, it was in the order of ((r = -0.842, r= -0.912, r=-0.957, r = -0.802, r = -0.934, r= -0.956, r= -0.840, r= -0.953 and r= -0.975) at 50 DAS during 2019-20, 2020-21 and pooled analysis respectively.

The result of correlation coefficients presented in Table1 revealed that seed yield was significantly and highly negative correlated with Monocot weedsdry biomass (g/m^2), Dicot weed dry biomass and total weeds dry biomass, it was in the order of ((r = -0.970, r= -0.817, r=-0.894, r = -0.933, r = -0.858, r= -0.911, r= -0.983, r= -0.859 and r= -0.923) at harvest during 2019-20, 2020-21 and pooled analysis respectively.

The result of correlation coefficients presented in Table1 revealed that seed yield was significantly and highly positive correlated with weed control efficiency at harvest (r= 0.894), where as seed yield was non significantly positive correlated with weed control efficiency at 25 and 50 DAS (r= 0.204 and r= 0.919) respectively.

As regards the predictions pertaining the reduction in grain yield due to monocot weed density, dicot weed density and total weeds density, it was in the order of 0.0079, 0.0104, 0.0046 t/ha at 25 DAS, 0.0148, 0.0296, 0.0101 t/ha at 50 DAS and 0.0389, 0.0503, 0.0259 t/ha at harvest for monocot weeds density, dicot weeds density and total weeds density respectively in pooled analysis. Prediction pertaining the reduction in grain yield due to monocot weed dry biomass, dicot weed dry biomass and total dry weed biomass, it was in the order of 0.0231, 0.0501, 0.0161 t/ha at 25 DAS, 0.0124, 0.0259, 0.0083 t/ha at 50 DAS and 0.0121, 0.0182 0.0076 t/ha at harvest for monocot weeds dry biomass, dicot weeds dry biomass and total weeds dry biomass respectively in pooled analysis. The prediction pertaining the increase in grain yield due to weed control efficiency at 25 DAS, 50 DAS and harvest, it was in the order of 0.0093, 0.0237, 0.0187 t/ha respectively for weed control efficiency at 25 DAS, 50 DAS and harvest in pooled analysis.

Conclusion:

From the result of the study, it is concluded that in *rabi* weed ecosystem of maize cultivation, controlling weed population at critical stage reduces weed density and weed dry biomass and increase weed control efficiency which in turn increases yield attributes and consequently grain yield of *rabi* maize. Straw yield, plant stand at harvest, plant height at 30, 60 DAS and at harvest shows the highly correlate with *rabi* maize grain yield.

REFERENCES:

Bollman JD., Boerboom CM., Becker RL., Fritz VA. (2008). Efficacy and tolerance to HPPD-inhibiting herbicides in sweet corn. *Weed Technology*, 22(4): 666–674.

Das A., Kumar M., Ramkrushna GI., Patel DP., Layek J., Naropongla Panwar AS., Ngachan SV. (2016). Weed management in maize under rainfed organic farming system. *Indian Journal of Weed Science*, 48(2): 168–172

Karlen DL., Cambardella CA., Bull CT., Chase CA., Gibson LR., Delate K. (2007). Producer–*Researcher Interactions in On-Farm Research. Agronomy Journa*l, 99(3):779-790.

Letourneau, DK., Armbrecht, I., Rivera, BS., Lerma, JM., Carmona, EJ., Daza, MC., Mejía, JL. (2011). Does plant diversity benefit agroecosystems? A synthetic review. *Ecological Applications*, 21(1): 9-21.

Stephenson DO, Bond JA. (2012). Evaluation of thiencarbazone-methyl- and isoxaflutole-based herbicide programs in corn. *Weed Technology*, 26(1): 37–42.

Sutton P., Richards C., Buren L., Glasgow L. (2002). Activity of mesotrione on resistant weeds in maize. *Pest Management Science*, 58(9): 981–984.

Swanton C.J., Gulden R.H., Chandler K. (2007). A rationale for Atrazine stewardship in corn. *Weed Science*, 55(1): 75–81.

Swetha, K., M. Madhavi, G. Pratibha and T. Ramprakash (2015).Weed management with new generation herbicides in maize. 25th Asian-Pacific Weed Science Society Conference on "*Weed Science for Sustainable Agriculture, Environment and Biodiversity*", Hyderabad, India during 13-16 October, 2015.

Vyn JD., Swanton CJ., Weaver SE., Sikkema PH. (2006). Control of Amaranthus tuberculatus var. rudis (C*ommon waterhemp*) with pre and post emergence herbicides in *Zea mays* L. (maize). *Crop Protection*, 25(9): 1051–1056.

Walsh MJ., Stratford K., Stone K., Powles SB. (2012).Synergistic effects of Atrazine and mesotrione on susceptible and resistant wild radish (*Raphanus raphanistrum*) populations and the potential for overcoming resistance to triazine herbicides. *Weed Technology*, 26(2): 341–347.

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