JOJ Wildlife and Biodiversity

Juniper Publishers key to the Researchers

Mini Review

Volume 2 Issue 4- August 2020

JOJ Wildl Biodivers

Non-statistically Significant Interactions between Treatments and an Approach for Dealing with these Statuses

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Submission: May 28, 2020; **Published:** August 10, 2020

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Abstract

A field experiment on cotton yield resulted in a non-statistically significant interaction. An approach for follow-up examination between treatments based on least significant difference values was suggested to identify the effect regardless of insignificance. It was found that the classical formula used in calculating the significance of interactions suffers a possible shortage that can be eliminated by applying a suggested revision.

Keywords: Cotton yield; Mepiquat Chloride; Nitrogen; Non-significant interactions; Potassium

Introduction

Managing the balance of vegetative and reproductive growth is the essence of managing a cotton crop. It is known from numerous fertilizer experiments that the yield of field crop is strongly dependent on the supply of mineral nutrients [1-3]. Several approaches have been used in an attempt to break this yield plateau; among them the application of plant growth regulators (PGR's), particularly Mepiquat Chloride (MC) has received much attention recent years [4,5].

Also, a statistical approach for dealing with the non-significant interactions between treatments depending on least significant differences, regardless of statistical insignificance is suggested [6].

Results

Effects of main treatments on yield

Seed cotton yield per plant, as well as seed cotton and lint yield per hectare, were increased by as much as 12.8, 12.8, and 12.3 %, respectively, when the nitrogen rate was increased [6]. N is an important nutrient for control of new growth and preventing abscission of squares and bolls and is also essential for photosynthetic activity [7,8]. When K was applied at all three rates (319, 638 and 957 g K per hectare), seed cotton yield per plant and seed cotton and lint yield per hectare also increased [6]. These increases could be attributed to the favorable effects of K on yield components, that is, the number of opened bolls per plant and boll weight leading consequently to higher cotton yield [9,10]. Mepiquat Chloride (MC) significantly increased seed cotton yield per plant, as well as seed cotton and lint yield per hectare (by 9.5, 9.6 and 9.3%, respectively), compared to the untreated control [6] that lead to yield enhancements of both boll retention and boll weight [10].

Effects of interactions between treatments on yield

No significant interactions were identified among the variables in this study (N rates, K rates and MC) with respect to the characters under investigation. Generally, interactions indicated that the favorable effects accompanied the application of N; spraying cotton plants with K combined with MC on cotton productivity was more obvious by applying N at 143 kg per hectare and combined with spraying cotton plants with K at 957 g per hectare and also with MC at 48 + 24 g active ingredient per hectare [6].

Regarding the non-significant interaction effects, increases were observed in seed cotton yield per hectare (about 40%) as a result of applying the same combination [6]. Differences were observed between the interactions in this study, that is, the first

order and the second order; however, these interactions were not statistically significance. Because it is possible that experimental error could mask the pronounced effects of the interactions [6] a statistical approach for dealing with the non-significant interactions between treatments is suggested.

Differences between treatment combinations regardless of the non-significance of the interaction effects from the ANOVA. Results show that, if no significant differences are identified between the different levels of any main factor (N, K or MC) when the LSD is calculated, then the significance does not exist. Conversely, if the significance of the interactions between the main factors (first and second order interactions) is not identified, then the estimation of the LSD of the interactions between the main factors could provide a significant result [6]. For these reasons, the formula used in calculating the significance of interactions suffers a possible shortage.

Study results indicate that it could be useful to modify or add to the original formula used for calculating F values of interactions [6] via:

F = Mean Square for Interaction / Mean Square for Error

In this connection, calculating the significance of interactions could proceed as:

F = Mean square for interaction × n / Root of mean square for error

Where n = number of main factors in the interaction.

Based on findings from this study, it may be concluded that the use of the suggested formula could secure the disclosure of any significant effects among interactions regardless of experimental error.

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How to cite this article: Zakaria M S. Non-statistically Significant Interactions between Treatments and an Approach for Dealing with these Statuses. JOJ Wildl Biodivers. 2020: 2(5): 555596