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Original Research Article

Foliar Spray of Ammonium Sulphate on Yield and Yield Components of Canola

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Abstract

The experiment entitle "Impact of ammonium sulphate foliar spray on canola yield and yielding components" was conducted at the Palatoo Research farm department of Agronomy, Amir Muhammad Khan Campus, Mardan during rabi season 2014-15.The treatments consist of ammonium sulphate (AS) 1%, 0.2% and 0.3% solution, and water spray as control. Randomized complete block design with four replications was used in the experiment. The results indicated that application of 1% AS improved pods plant^{-1} 46 (control) to 58 (treated), grains pod^{-1} 24 (control) to 31 (treated), biological yield kg ha^{-1} 621.97 (control) to 771.17 kg ha^{-1} (treated), grains yield 268.33 (control) to 341.00 kg ha^{-1} (treated) ,thousands grains weight (g) 4.23g (control) to 5.22g (treated) and HI 28.20 (control) to 33.70% of (treated).The application of 0.2% AS produced pods plant^{-1}(43) grains pod^{-1}(23) biological yield(646.93 kg ha^{-1}) grains yield^{-1}(235.33 kg ha^{-1}) thousands grains weight (g) (4.23g) and HI (28.97%).and the application of 0.3% AS produced pods plant^{-1}(55) grains pod^{-1} (29) biological yield (739.27kg ha^{-1}) grains yield^{-1}(331.67 kg ha^{-1}) thousands grains weight (4.33 g) and HI (31.40%).Therefore on the basis of the experiment 1% AS is suggested for application on canola to improve its yield and yielding components.

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Keywords

Ammonium sulphate
Brassica napus
Canola
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Introduction

Rapeseed (*Brassica napus* L.) belongs to the Cruciferaceae (Brassicaceae) family, and the common species are *B. nigra*, *B. carinata*, *B. juncea*, *B. oleracea* and *B. compestris* (Holmes, 1980). Rapeseed or mustard was grown from 300 BC in Indus valley of Pakistan as a fodder crop. Rapeseed and mustard are traditional oil seed crops of Pakistan which are grown in large area of four provinces of country (Khan et al., 2004). Canola was introduced in Pakistan during 1995 for general cultivation to replace traditional oilseed crops like rapes and mustards because of its low erusic acid contents and high yielding capacity (Chaudhry et al., 2011). During 2011-12 in Pakistan the Canola crop was cultivated in 14700 ha with the production of 7000 tones, while Khyber Phukhtunkhwa the area under cultivation was 1300 ha with a total production of 1800 tones (MNFSR, 2012). Like all other crops, growth, developmental process and grain yield of canola depends upon biotic and abiotic factors. Sulfur is the fourth major plant nutrient after nitrogen, phosphorus and potassium. It is essential for synthesis of the amino acids like cystine, and methionine, a component of vitamin A and activates certain enzyme systems in plants (Havlin et al., 2004). It is also an important soil fertility factor to consider when growing canola (Ghosh et al., 2000) because of high requirement of S by Cruciferae family (Scherer, 2001). The seed yield, total dry matter and harvest index in some genotypes of *Brassica napus* and *Brassica juncea* has been found to improve with higher rate of sulphur (Chandel et al., 2002; Malhi et al, 2007).

Sulphur deficiency adversely reduces yield, protein and enzyme synthesis (Scherer, 2001). Sometimes Plant immobility makes the nutrient deficient and S deficiency at any growth stage can cause considerable reduction in seed yield of canola and thus a regular supply of available S is required throughout the growing season (Malhi and Gill, 2002). Plant nutrients availability at appropriate time and amount is predictable to harvest optimal yields (Habtegebrial and Singh, 2006).

Soil fertility status varies with nature of cropping pattern and management practices. In Pakistan, entire available soil is almost nutrient deficient (Anon., 2008). Soils are generally deficient in organic matter content reflecting the severe deficiency of nitrogen (almost 100%) with phosphorus deficiency in more than 90% soils and potassium in 50% soils (Anon., 2009). Micronutrients; zinc, boron and iron are also emerging as deficient. Ahmad and Khan (2006) declared that 75-92% soils of Pakistan are deficient in organic matter (0-1%), 70-95% in phosphates and 20-60% soils in potash.

Keeping in view the importance of ammonium sulphate present research was conducted in order to study the response of canola to different application of foliar spray on canola. To characterized the response of foliar application ammonium sulphate (1%, 0.2%, and 0.3%) on canola yield and its yield components.

Materials and methods

Ammonium sulphate foliar application on canola yield and yielding components" was conducted at the Palatoo research farm Department of Agronomy, Amir Muhmmad khan Campus, Mardan during rabi season 2014-2015. The experiment consisted of ammonium sulphate levels (1%, 0. 2% and 0.3%) and water spray. The experiment was laid out in randomized complete block, having four replications. The plot size was 2×2 m². Ploughing was done with help of cultivator. The basal dose N and P at the rate of 70 and 40 k ha^{-1} was applied. Respectively, Hoeing was carried out after rosette stage to control weeds. All the agronomic practices were applied according to crop need.

In order to count the number of branches 10 plants were randomly selected from each plot and their branches were counted and averaged. Three plants from each plot were randomly selected. Their pods were counted and averaged. Grain $pods^{-1}$ data 10 pods were randomly selected, threshed, counted their seed and averaged. Calculating biological yield, four central rows in each plots were harvested, dried for 10 days and weighed. Biological yield kg ha^{-1} determined by using following formula and four central rows were harvested from each plot using a sickle and sun dried for 10 days and threshed. The grains were collected weighed by electronic balance and then converted into kg ha^{-1}. Thousand grain weights were counted by randomly collecting sample from grain obtained from the plot after threshing of each treatment and weighed to record 1000-seed weight. To calculate harvest index, the grain yield was divided by biological yield and multiplied by 100 to express the data as percentage.

Statistical analysis

The data recorded was analyzed statistically using analysis of variance techniques appropriate for randomized complete block design .Means were compared using LSD test at 0.05 level of probability, when the F-values were significant (Sharifi, 2012; Malik et al., 2004).

$$\text{Biological yield (kg ha}^{-1}\text{)} = \frac{\text{biological yield plot}}{\text{row to row dist. x no of rowsxrow lenght}} x10000$$

$$\text{Grain yield (kg ha}^{-1}\text{)} = \frac{\text{Grain yield plot}^{-1}}{\text{row to row dist. x no of rowsxrow lenght}} x10000$$

$$\text{Harvest index (\%)} = \frac{\text{Grain yield}}{\text{biological yield}} x100$$

Results and discussion

Number of branches $plant^{-1}$

The data regarding number of branches $plant^{-1}$ is presented in Fig. 1. Statistical analysis shows that ammonium sulphate had no significant affect on number of branches of canola. The possible reason might that it is genetically character which cannot be effected by external application of fertilization/ nutrients respectively. As the ammonium sulphate solution was applied to crop in very less concentration and after branch formation stage of canola, therefore number of branches plant^{-1} were not significantly affected.

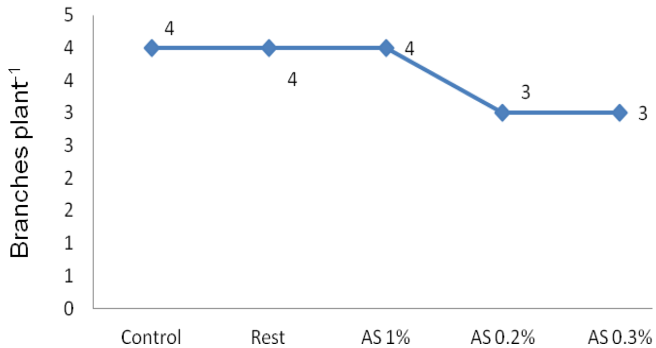

Fig. 1: Branches plant^{-1} of canola as influenced by ammonium sulphate foliar application levels **(**AS = ammonium sulphate).

Number of pods plant^{-1}

The data regarding number of pods plant^{-1} is presented in Fig. 2. Statistical analysis shows that there were significant differences in number of pods due to ammonium sulphate foliar application on canola. More pods plant^{-1} (58) were obtained with the application of 1% ammonium sulphate as compare to control, 0.2%(43) , 0.3% (55) and control (46). The result is also in agreement with the findings of Sharifi (2012) and Sattar et al. (2011) who found that the pods in plants increases with higher rate of sulphur application. Furthermore canola is an oil seed crop and responds more positively to sulphur, therefore it may be one of the reasons that increase in sulphur rate leads to produce more pods plant^{-1} (Malik et al., 2004).

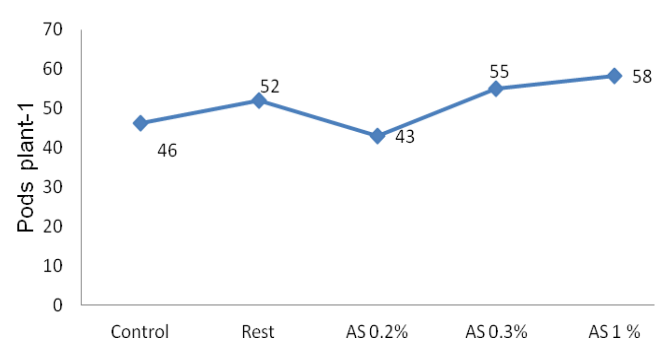

Fig. 2: Pods plant^{-1} of canola as influenced by ammonium sulphate foliar application levels **(**AS = ammonium sulphate).

Grain pods^{-1}

The data regarding number of grains pods^{-1} is presented in Fig. 3. Statistical analysis shows that there is a significant difference in number of grains pods^{-1} due to ammonium sulphate foliar application on canola. Maximum grains pods^{-1} (31) were obtained with the application of 1% ammonium sulphate as compare to control, 0.3% (28) 0.2%(23) and control (24) solution. These results are also in line with the early research done by Sharifi (2012) and Malik et al. (2004) who found the higher grains pods^{-1} which increases with the high application of sulphur solution. Moreover it has proved by that canola an oil seed crop response very well to higher rate of sulphur application which resulted in increased grains pods^{-1}. (Sattar et al., 2011).

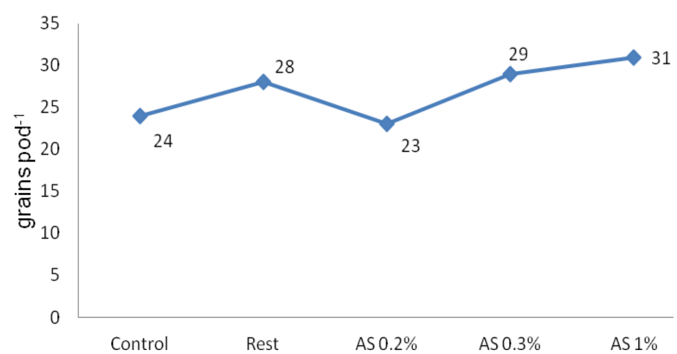

Fig. 3: Grains pod^{-1} of canola as influenced by ammonium sulphate foliar application levels **(**AS = ammonium sulphate).

Biological yield (kg ha^{-1})

The data regarding on biological yield presented in Fig. 4. Statistical analysis shows that there is a significant affect in biological yield due to ammonium sulphate foliar application on canola. More biological yield (771.17 kg ha^{-1}) was obtained with the application of 1% ammonium sulphate as compare to control (621.97 kg ha^{-1}), 0.2% (646.93 kg ha^{-1}) and 0.3% (739.27 kg ha^{-1}) solution. The results of the present study are in line with the findings of Malik et al. (2004), Jan et al. (2008) and Sattar et al. (2011) who found that from higher rate of sulphur application more biological yield can be obtained.

Grain yield (kg ha^{-1})

The data regarding on grain yield plot^{-1} presented in Fig. 5. Statistical analysis shows that there is a significant affect in grain yield due to ammonium sulphate foliar application on canola. More grain yield (341 kg ha^{-1})

were obtained with the application of 1% ammonium sulphate as compare to control (268 kg ha^{-1}), 0.2% (235 kg ha^{-1}) and 0.3% (332 kg ha^{-1}) solution. The result is also in agreement with the findings of Sharifi (2012) who observed that increasing levels of sulphur solution increased grains yield. Canola which is an oil seed crop response positively to sulphur application due to which its grain yield increases (Malik et al., 2004).

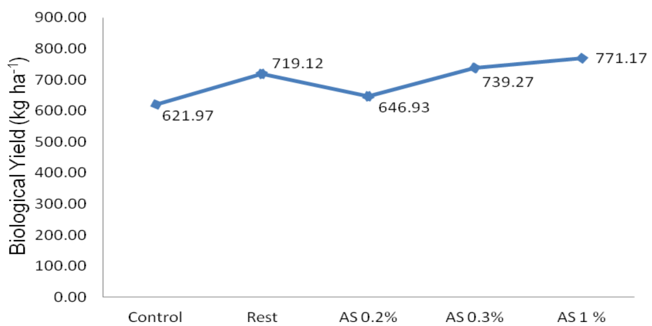

Fig. 4: Biological yield of canola as influenced by ammonium sulphate foliar application levels (AS = ammonium sulphate).

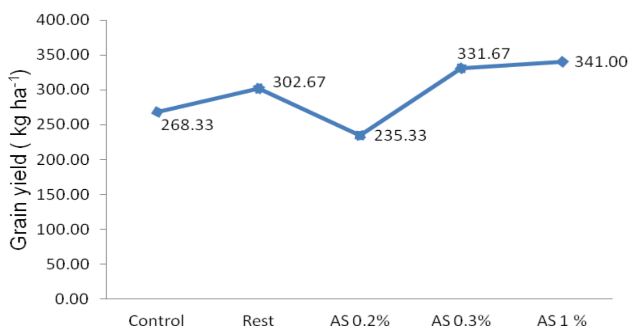

Fig. 5: Grains yields of canola as influenced by ammonium sulphate foliar application levels (AS = ammonium sulphate).

Thousand grain weight (g)

The data regarding on 1000 grains weight presented in Fig. 6. Statistical analysis shows that there is a significant difference in thousand grain weight due to ammonium sulphate foliar application on canola. More 1000 grains weight (5.22g) were obtained with the application of 1% ammonium sulphate as compare to control (4.23), 0.2% (4.23) and 0.3% (4.33) solution. The results are also in agreement with the findings of Sharifi (2012) and Sattar et al. (2011) who have reported increasing levels of sulphur application increased thousand grain weights.

Harvest index (%)

The data regarding on HI presented in Fig. 7. Statistical analysis shows that there is a significant difference in harvest index due to ammonium sulphate foliar application on canola. More HI (33.70%) were obtained with the application of 1% ammonium sulphate as compare to control (28.20%), 0.2% (28.97%) and 0.3% (31.40%). The results are also in agreement with the findings of (Sattar et al., 2011). Canola as an oil seed crop respone more positively to sulphur solution so increase in sulphur rate more HI can be obtained (Jan et al., 2008).

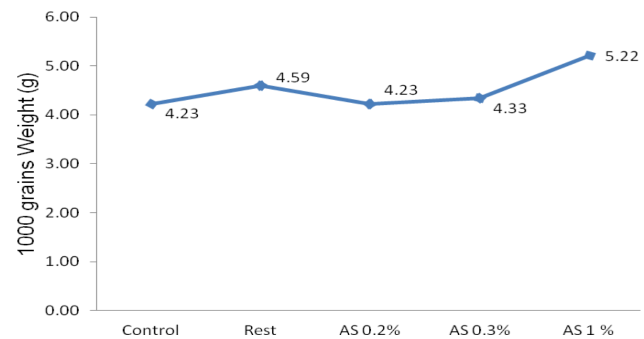

Fig. 6: Thousands grain weight of canola as influenced by ammonium sulphate foliar application levels (AS= ammonium sulphate).

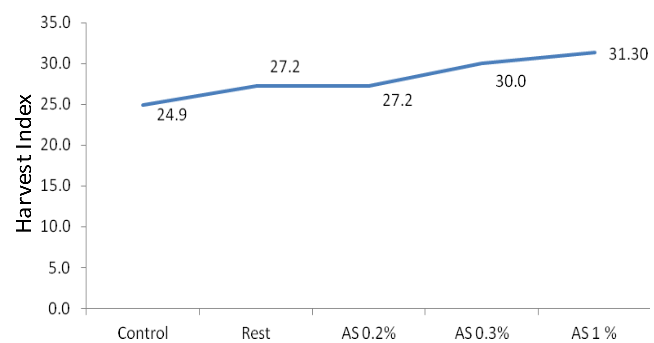

Fig. 7: Harvest index of canola as influenced by ammonium sulphate foliar application levels (AS = ammonium sulphate).

Conclusion

It is concluded from the experimental results that foliar application of 1% ammonium sulphate significantly increased the yield and yielding components of canola.

Conflict of interest statement

Authors declare that they have no conflict of interest.

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