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Original Research Article

Phenological Traits of Canola in Response to Different Concentrations of Ammonium Sulphate Foliar Spray

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Abstract

There is usually a positive yield response when sulfur (S) is applied to rapeseed (*Brassica rapa* L.) plants grown on S-deficient soils. Canola, being a conventional oil seed and winter season crop that is grown successfully in Pakistan. Research was conducted to study "phonological traits of canola in response to different concentrations of ammonium sulphate foliar spray" at Agronomy Res. Farm, Univ. of Agriculture, Peshawar in season 2014-15. The experiment consisted of ammonium sulphate foliar spray concentrations (1%, 0. 2% and 0.3%) and control means water spray in randomized complete block design replicated four times. Results showed that Number of leaves and number of branches were non significant while the rest phonological traits were affected significantly. Less days to flowering (303), Days to pod formation (350), Days to maturity (469), and more biological yield (3856 kg ha^{-1}) and grain yield (2360 kg ha^{-1}) were recorded for 1% foliar application of sulphur. While maximum data were recorded in plots with no foliar spray for (days to flowering, days to pod formation and days to maturity) and less biological and grain yield. Data revealed that foliar application of ammonium sulphate at rate of 1% S was more efficient as compared with control for the phenological traits of canola. From this study, it was concluded that phonological traits were substantially improved by the foliar application of sulphur @ 1%.

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Keywords

Ammonium sulphate
Canola
Foliar spray
Phenological traits

Introduction

Rapeseed (*Brassica napus* L.) belongs to the Cruciferae 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 300Bc in Indus valley of Pakistan as a fodder crop. Rapeseed and mustard are traditional oil seed crops of Pakistan 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 erucic 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 and 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 percent 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 percent soils in potash.

Keep 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 the objectives to determine the effects of ammonium sulphate (1%, 0.2%, and 0.3%) foliar application on canola phenology and traits.

Materials and methods

The experiment 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 and crop sown. The basal dose N and P @70 and 40kg^{-1} ha applied respectively. Hoeing was carried out after rosette stage to control weeds. All the agronomic practices were applied according to crop need.

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).

Results and discussion

Number of leaves plant^{-1}

Data regarding number of leaves as influenced by different levels of Ammonium Sulfate foliar spray is presented in Fig. 1 and Table 1. Statistical analysis of the data had showed non-significant effect. However, the number of leaves generally increased with the increasing levels of Ammonium sulfate as foliar spray. The possible reason might be 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, therefore the number of leaves was not significantly affected.

Table 1. Phenological traits and yield of canola as affected by ammonium sulphate foliar application.

Ammonium sulphate	No. of leaves plant^{-1}	No. of branches	Days to pod formation	Days to flowering	Days to maturity	Biological yield	Grain yield
0.20%	16	16	371.5	305	471.75	1568	1698
0.30%	16	17	367.75	308.25	471.75	3233	2323
1%	17	15	350	303.5	469.5	3856	2360
Control	15	16	372.5	309.25	484	2726	2147

Number of branches plant^{-1}

Number of branches per plant as influenced by different levels of Ammonium Sulfate foliar spray is presented in Fig. 2. Analysis of the data had showed non-significant effect on branches per plant. However, the number of

branches generally increased with the increasing levels of Ammonium sulfate as foliar spray. The possible reason might be 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, therefore the numbers of branches were not significantly affected.

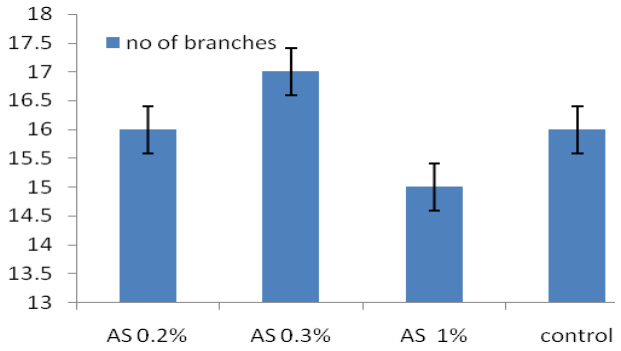

Fig. 1: Number of branches of Canola as affected by different levels of ammonium sulphate foliar application.

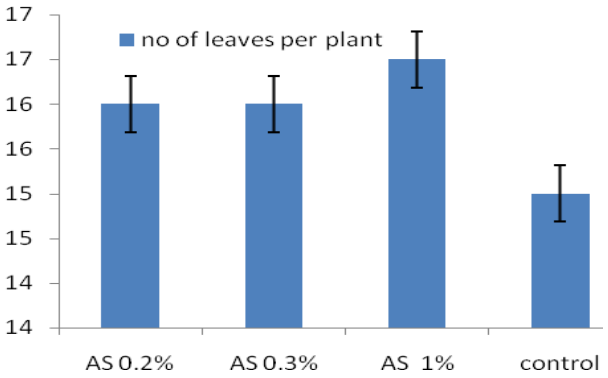

Fig. 2: Number of leaves per plant of Canola as affected by different levels of ammonium sulphate foliar application.

Days to flowering

Data regarding days to flowering as influenced by different levels of Ammonium Sulfate foliar spray is presented in Fig. 3. Statistical Analysis of the data had showed significant effect on number of days taken to initiation of flowers formation. Maximum days to flower formation initiation (303) were noticed by the application of 1 % foliar application of Ammonium sulfate, followed by 0.3 % foliar spray (308) while minimum days to flowering (309) was recorded in plots with no spray. These findings are also in line with (Brandt et al., 2007).

Days to pods formation

Pods formation of canola as influenced by different levels of Ammonium Sulfate foliar spray is presented in Fig. 4. Statistical Analysis of the data had showed significant effect on number of days taken to pods formation. Maximum days to pods formation (350) were recorded by the application of 1 % foliar application of Ammonium sulfate, followed by 0.3 % (367), 0.2 % (371) while minimum days (372) were recorded in plots with no spray. These findings are also in line with Brandt et al. (2007).

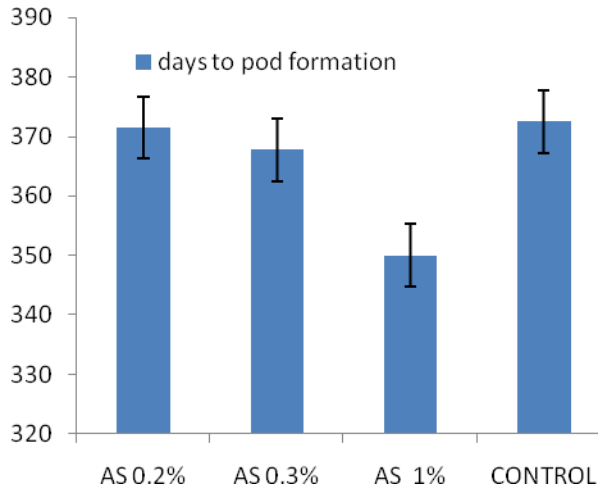

Fig. 3: Days to pod formation of Canola as affected by different levels of ammonium sulphate foliar application.

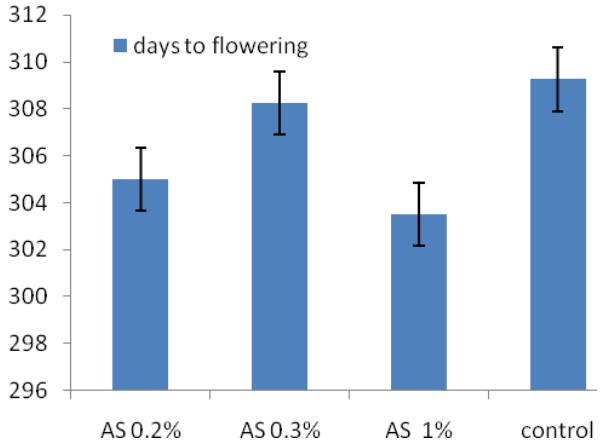

Fig. 4: Days to flowering of Canola as affected by different levels of ammonium sulphate foliar application.

Days to maturity

Number of days taken from sowing till the maturity of the crop as affected by different levels of Ammonium

Sulfate foliar spray is given in Fig. 5. Based on statistical analysis of the data, a significant effect on number of days taken to crop maturity was observed. Maximum days to maturity (469) were observed for 1% foliar application of Ammonium sulfate, followed by 0.3 % (471) which is statistically at par with 0.2% spray while minimum days to maturity (484) were recorded in plots with no spray. These findings are also in line with Nakhlaway et al. (2007) and Cheema et al. (2007).

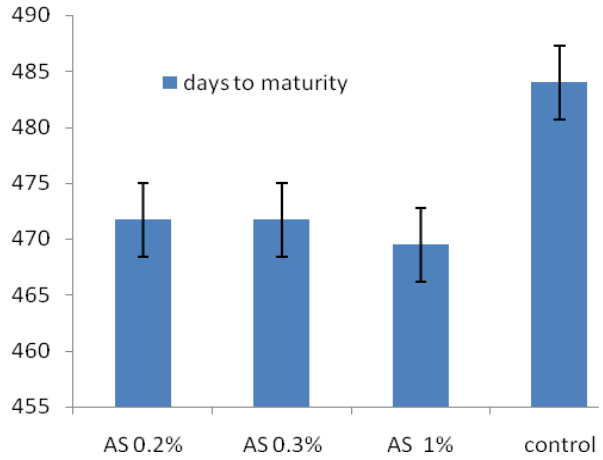

Fig. 5: Days to maturity of Canola as affected by different levels of ammonium sulphate foliar application.

Biological yield (kg ha^{-1})

Data regarding on biological yield is presented in Fig. 6. Statistical analysis shows that there is a significant effect on biological yield of canola due to ammonium sulphate foliar application. Maximum biological yield (3856 kg ha^{-1}) were obtained with the application of 1% ammonium sulphate as compare to control (2726 kg ha^{-1}), 0.2% (1568 kg ha^{-1}) and 0.3% (3233 kg ha^{-1}) solution. The result 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})

Grain yield kg ha^{-1} of canola as affected by ammonium sulfate foliar spray is presented in Fig. 7. Statistical analysis shows that there is a significant affect in grain yield due to ammonium sulphate foliar application on canola. More grain yield (2360 kg ha^{-1}) was obtained with the application of 1% ammonium sulphate as compare to control (2147 kg ha^{-1}), 0.2% (1700 kg ha^{-1}) and 0.3% (2323 kg ha^{-1}) solution. The result is also in agreement with the findings of (Sharifi, 2012) who reported that increasing levels of sulphur solution increased grains yield of canola which is an oil seed crop, respond positively to sulphur application due to which its grain yield increases. (Malik et al, 2004).

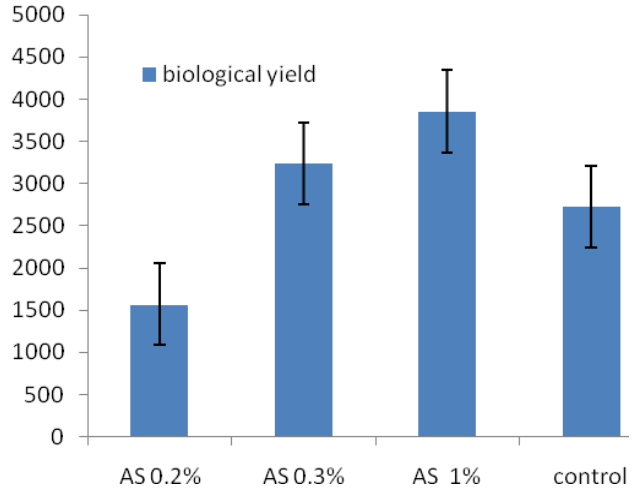

Fig. 6: Biological yield (kg ha^{-1}) of Canola as affected by different levels of ammonium sulphate foliar application.

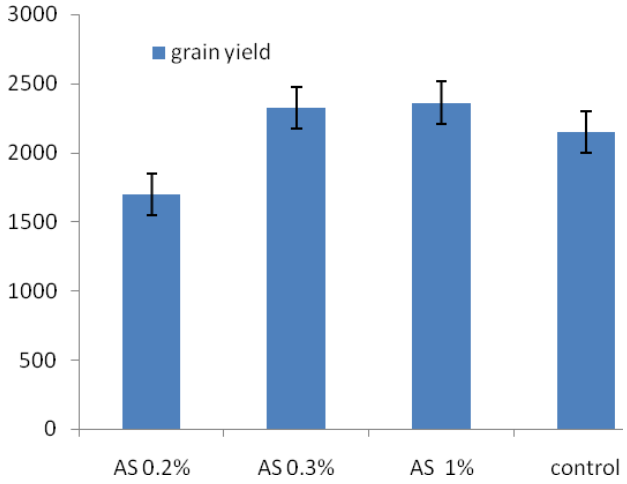

Fig. 7: Grain yield (kg ha^{-1}) of Canola as affected by different levels of ammonium sulphate foliar application.

Conclusion and recommendation

From this experiment it was concluded that number of leaves and branches were not affected by ammonium sulphate foliar spray while less days to flowering (303), days to pod formation (350), days to maturity (469), more biological yield (3856 kg ha^{-1}) and grain yield (2360 kg ha^{-1}) were recorded for 1% foliar application of sulphur. On the basis of current research it is recommended that ammonium sulphate @ 1% foliar

spray is optimum for achieving phenological attributes and yield of canola.

Conflict of interest statement

Authors declare that they have no conflict of interest.

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