Foliar-applied potassium nitrate increased wheat grain yield in Italy up to 17%.

On behalf of the Potassium Nitrate Association (PNA), Landlab research station in Quinto Vicentino (Italy), conducted a trial to test the effect on winter wheat yield of two foliar applications with potassium nitrate (KNO_3) in spring.

Trial design

Winter wheat variety 'Illico' was sown November 14, 2013, in the last available "sowing window" of the year. Before sowing, the silt loam soil at the trial site was amended with 20-25% of silica sand, mixed in the top 20-25 cm of the soil. Standard N application was 150 kg N/ha, base dressed as ammonium nitrate at sowing time (30 kg N/ha) and as urea in two split applications in March (60 kg N/ha each). K was applied as KCl with the ammonium nitrate, at four levels based on the supposed K removal, presuming an expected grain yield range of 6,5-7,0 MT/ha. The four K levels were combined with two foliar potassium nitrate applications or with no foliar application (control). Potassium nitrate was sprayed at different growth stages: active tillering (March 7) and panicle initiation (March 28), at 10 kg KNO_3/ha/spray in a spray volume of 400 l/ha. The 8 treatments in this trial were laid out in a randomized block design with 5 replicates in 6 m^2 plots.

The response of the plants to the foliar applications was measured as plant height in May and half June, and SPAD-measurement (an index of the nutritional status of the plant) were done in April and May. After heading, the number of ears per m^2 was counted. The crop was harvested June 23rd and total grain yield, protein content, and dry matter content and 1000 grain weight were measured.

Results

Due to favourable climate conditions conditions (a very mild winter and frequent rainfall) the average yield of the trial was 7,58 MT/ha, about 1 MT above the expected yield, but in line with the potential of the area. Differences in wheat grain yield levels in response to the potassium treatments were clear and statistically strongly supported. The foliar applications of potassium nitrate were promoting a higher grain yield compared to the untreated controls, which resulted in additional grain yields ranging from 600 kg/ha to 1300 kg/ha (+8% to 17%). Foliar applications with KNO_3 were beneficial at any level of basal dressed K, even when provided at 100% of the expected K removal (Figure 1).

Greatest yield was obtained in the treatment that received 100% basal-dressed K (equivalent to 96 kg K_2O/ha or 160 kg KCl/ha) in combination with two foliar sprays of 10 kg potassium nitrate per ha per spray. Interestingly, the two foliar applications of KNO_3 in combination with 0% or 50% basal-dressed K treatments, resulted in higher yield levels compared with 100% basal-dressed K without two foliar potassium nitrate applications (Figure 1 and Table 1).

Foliar potassium applications did not affect plant height and no significant differences between the treatments were found. Neither did the SPAD measurements differ between the treatments: these showed very low variation due to excellent climate that made nitrogen highly available for uptake.

VZW POTASSIUM NITRATE ASSOCIATION (PNA)
Non-profit Association
Heidestraat 36, Bus A
1742 Ternat
Belgium

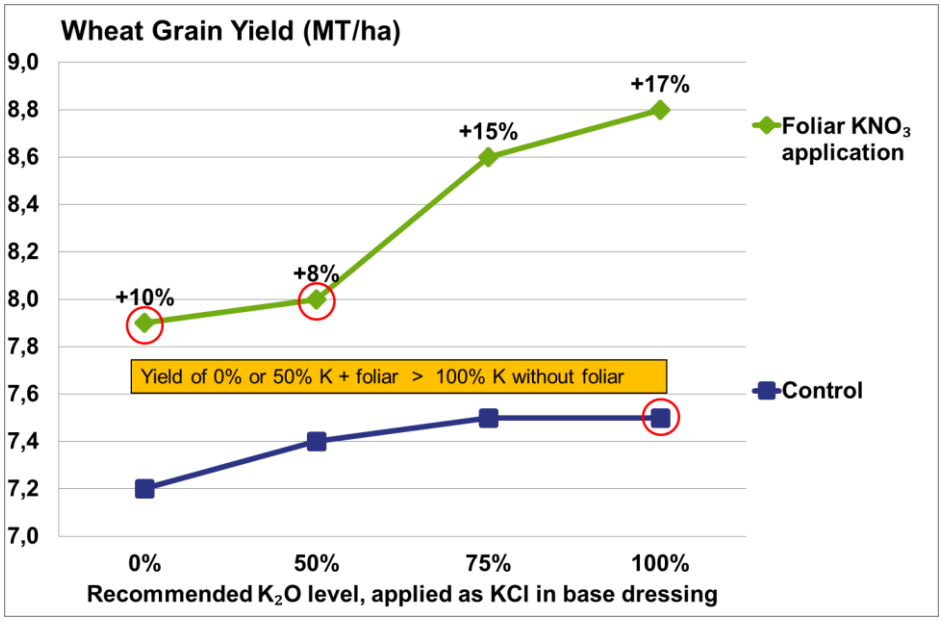

Figure 1. Effect of different base dressing applications and two foliar potassium nitrate sprays (10 kg/ha/spray) on wheat grain yield.

Table 1. Treatment variables, average number ears/m^2 and resulting wheat grain yield. The same letters behind the means indicate no significant difference (two-way Anova, Duncan at the α given in the column header)

Foliar applied KNO_3 (total kg KNO_3/ ha in two applications)	Base dressed KCl % of K removal*	K_2O/ha	Grain yield (MT/ha) Duncan (α=0,001)	Ears/m^2 (number) Duncan (α=0,05)
0	0	0	7,2 a	805 a
	50	48	7,4 a	792 a
	75	72	7,5 ab	807 a
	100	96	7,5 ab	792 a
20	0	0	7,9 abc	854 ab
	50	48	8,0 abc	978 b
	75	72	8,6 bc	908 bc
	100	96	8,8 c	933 c

* at a predicted yield of 6,5-7,0 MT/ha yield
** as base dressed KCl

The increase in yield could not be attributed to a higher 1000 grain weight or dry matter content. Neither did the protein content of the grain differ. There was a significant effect of the foliar application of potassium nitrate on the number of ears/m^2 (Table 1): on average for all sprayed entries 921 ears/m^2 were counted, as opposed to 799 ears/m^2 for the treatments without foliar application of potassium nitrate. The basal K level did not seem to affect the number of ears.

Conclusion

The time and placement of foliar application of potassium nitrate caused 17% yield increase even at the highest K level in the base dressing. The foliar application of KNO_3 is promoting a higher yield compared to the untreated entries and the foliar applied K is efficient for increase of yield, mainly due to more ears/m^2. The yield results are clear and statistically strongly supported at a very high level of confidence.

The study is confirming the benefit of potassium nitrate applied twice as foliar spray, in the key moment of the crop cycle, at 10 kg/ha/application over all four levels of K in the base dressing nutrition.