Boosting banana production - Potassium nitrate is the right fertilizer to optimize return on investment

Net benefit increased with up to 19% by application of KNO_3 compared to other granular K sources containing KCl and K_2SO_4 in a scientifically designed trial investigating yield of Williams bananas in South Africa.

Large differences in Williams banana plant performance were found in a scientific trial, testing the response to fertilization with prilled potassium nitrate (KNO_3: as Qrop K), potassium sulphate (K_2SO_4) or potassium chloride (KCl). The banana yield (total hand weight) averaged across two varied N and K rates was best for Qrop® K with 35.4 mt/ha and substantially lower for K_2SO_4 (32.8 mt / ha, – 7%) and KCl (28.5 mt/ha, – 20%). Application of Qrop® K resulted in the best performance in marketable yield and fruit quality parameters. Fruit weight and quality parameters were reduced where KCl was applied: a statistically significant difference.

The application of Qrop® K turned out to be a profitable investment for the grower

The highest yield of 40 mt / ha was recorded for Qrop® K, at the higher rate of N and K. N applied at 300 kg/ha and K applied at 700 kg/ha, resulted in a 24% and 19% higher marketable yield, relative to less N (200 kg N/ha) or less K (450 kg K/ha).

The trial was set up by SQM Africa in the Lowveld region of South Africa in collaboration with AgNova (Pty) Ltd. A factorial design with randomized complete blocks in which three K sources, two N rates and two K rates were varied: with a total of 12 treatment combinations with 20 replicates each. This enabled to show the

differences between Qrop® K and KCl which were statistically significant at the 5% level for all measurements except for total bunch weight (including stalk) which nevertheless showed a strong decline using KCl. It might be concluded that chloride uptake negatively impacted on plant growth and thus total yield. Alternatively, or additionally, the potassium nitrate as Qrop® K may have given rise to improved nutrition and thus plant health due to enhanced ability of increased nitrates to promote the uptake of the other cation plant nutrients such as K^+, Ca^{++} and Mg^{++}, which make up the bulk of the nutrient salts required by plants.

The detailed results of the bunch analyses are given in Table 1 and the marketable yield of the K-sources compared to potassium nitrate (Qrop® K) is plotted in Figure 1. All measurements bore positive relationships with each other. Larger bunches thus have more hands and heavier hands bearing more fingers of greater girth. Increased bunch weight signifies increases of all the attributes. No interactions between the three factors (K-source, N-rate and K-rate) were found. Using Qrop® K as K-source, resulted in the greatest plant productiveness in marketable total hand weight, with increased return on investment for the grower. Increased N and K levels increased productiveness, which probably relates to the high demand of the banana crop for both nutrients as well as the infertile state of the soil in which the plants of the trial were planted. Application of KCl reduced total hand weight by an order of 20% (Figure 1) compared to the bunches produced by plants fertilized with KNO_3 for K, and 13% relative to bunches produced by plants fertilized with K_2SO_4 for K, with the difference between KNO_3 and K_2SO_4 for K being less 7% (Figure 1).

Based on fertilizer costs and banana prices per box for July 2020, the difference in cost between the programs with the different K-sources (balanced with LAN) was: R13515 between the Qrop® K and KCl and R6545 / ha between Qrop® K and K_2SO_4, with the he Qrop® K being more expensive.

However, taking the increased yield into account and at R150 per box, the increased total income per hectare per crop cycle for the grower is R51 345 per hectare for Qrop ® K over KCl and R19 365 per hectare for Qrop® K over K_2SO_4, which more than compensates for extra input costs of the Qrop® K (Table 2).

Table 1. Yield parameter, means of the main effects per factor. The data was analyzed with a suitable statistical method: ANOVA for main effects and interactions, followed by 95% LSD mean separation for factor means. Means followed by the same letters in the same factor are not statistically different at p<0.05.

-	-	Brush weight (kg)	Hands per bunch	Ave. hand weight (kg)	Total hand weight (kg)	Ave. number fingers per hand	Finger lenght (cm)	Finger girth (cm)
K-source	KNO_3 (Qrop® K)	22.00 a	9.20 a	2.24 a	21.26 a	17.93 a	15.12 a	14.98 a
	K_2SO_4	21.11 a	9.01 ab	2.11 ab	19.44 ab	17.44 ab	14.87 ab	14.44 ab
	KCl	19.77 a	8.64 b	1.88 b	17.07 b	16.80 b	14.56 b	14.14 b
N-rate	200 N	18.72 a	8.52 a	1.94 a	17.28 a	16.72 a	14.56 a	14.22 a
	300 N	23.20 b	9.37 b	2.21 b	21.39 b	18.07 b	15.13 b	14.82 b
K-rate	450 K	18.79 a	8.53 a	1.97 a	17.67 a	16.82 a	14.55 a	13.94 a
	700 K	23.13 b	9.37 b	2.18 b	21.00 b	17.96 b	15.15 b	15.10 b

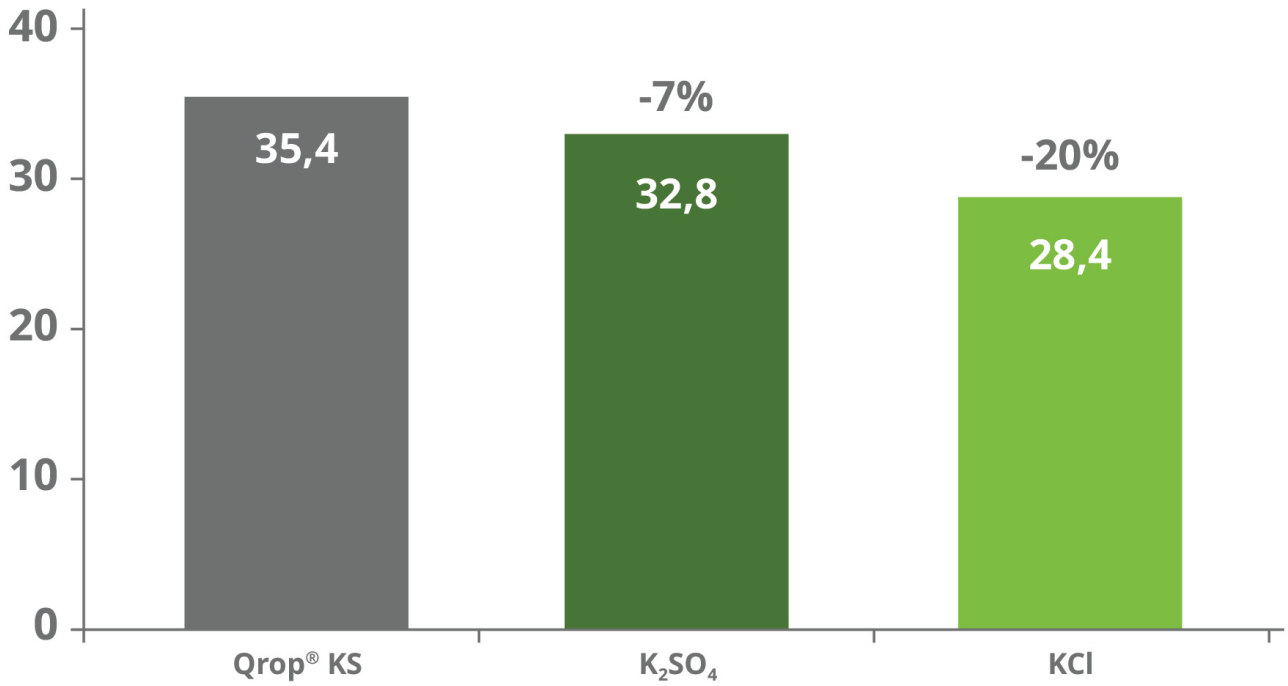

Figure 1. Total marketable yield and relative differences compared to Qrop ® K of Williams banana plants fertilized with potassium nitrate (Qrop® K), potassium sulphate (K_2SO_4) or potassium chloride (KCl) as K-source.

Table 2. Financial analyses of revenue in this trial. The analyses depart from the mean effect in yield of different K-sources over varied rates of N and K.

-	Total hand weight	Bunches per ha	Yield	18 kg boxes per ha	Price per box	Total income	Cost of NK fertilizer	Net benefit
K-source	kg/plant	Number	MT/ha	Number	R/box	R/ha	R/ha	R/ha
KNO_3 (Qrop® K)	21.26	1667	25.4	1969	150	295,350	24,633	270,717
K_2SO_4	19.68	1667	32.8	1823	150	273,450	18,088	255,362
KCl	17.07	1667	28.5	1581	150	237,150	11,118	226,032