

Efficiency of Polyhalite as a Sulphur Source on Wheat in Argentina

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Introduction

Polyhalite is one of a number of evaporate minerals containing potassium (K). Polyhalite (dihydrate) is a single crystal complex with two molecules of water of crystallization. It is not a mixture of salts. The chemical formula is: $K_2Ca_2Mg(SO_4)_4 \cdot 2(H_2O)$, and contains 48% SO_3 , 14% K_2O , 6% MgO and 17% CaO .

One important characteristic of Polyhalite is the prolonged release and availability of nutrients, especially in relation to sulphur (S).

Objective

The objective of this research was to compare the agronomic efficiency of fertilizer bulk blends that include Polyhalite, on wheat production in Argentina, under field conditions.

Material and methods

- **Place:** Nueve de Julio, Buenos Aires, Argentina.
- **Soil:** The main parameters of the arable layer (0-20 cm) of the trial soil were: pH = 5.9; organic matter = 29 g kg^{-1} ; phosphorus (P)-Bray = 9.8 mg kg^{-1} ; $S-SO_4 = 7.1$ mg kg^{-1} ; K = 1.23 cmolc kg^{-1} ; calcium (Ca) = 6.5 cmolc kg^{-1} ; magnesium (Mg) = 1.36 cmolc kg^{-1} . The soil is of sandy loam texture, and the low organic matter and available $S-SO_4$ levels indicate a potential for nutrient response.
- **Experimental design:** Randomized complete block design with four replications, comprising six treatments.
- **Treatments:** different blends of monoammonium phosphate (MAP) plus sources of S, in order to apply a single rate of P_2O_5 (30 $kg ha^{-1}$) and variable rates of S (0 to 57 $kg ha^{-1}$) at sowing, according to Table 1.



Table 1. Description of treatments

Treatment	Fertilizer	N	P_2O_5	S	K_2O	CaO	MgO
kg ha^{-1}							
1 Control - MAP (No S)	58	6	30	-	-	-	-
2 Single superphosphate (SSP)	158	0	30	19	-	-	-
3 MAP + gypsum	167	6	30	19	-	-	-
4 MAP + 100 $kg ha^{-1}$ Polyhalite	158	6	30	19	14	17	6
5 MAP + 200 $kg ha^{-1}$ Polyhalite	258	6	30	38	28	34	12
6 MAP + 300 $kg ha^{-1}$ Polyhalite	358	6	30	57	42	51	18

Note: Treatment 1: 58 $kg ha^{-1}$ MAP (11-52-0-0S). Treatment 2: 158 $kg ha^{-1}$ SSP (0-19-0-12S). Treatment 3: bulk blend of 58 $kg ha^{-1}$ MAP and 109 $kg ha^{-1}$ granular gypsum (0-0-0-17S). Treatments 4 to 6: bulk blends of 58 $kg ha^{-1}$ MAP and Polyhalite (0-0-14-19S -17CaO - 6MgO), respectively 100, 200 or 300 $kg ha^{-1}$ of Polyhalite.

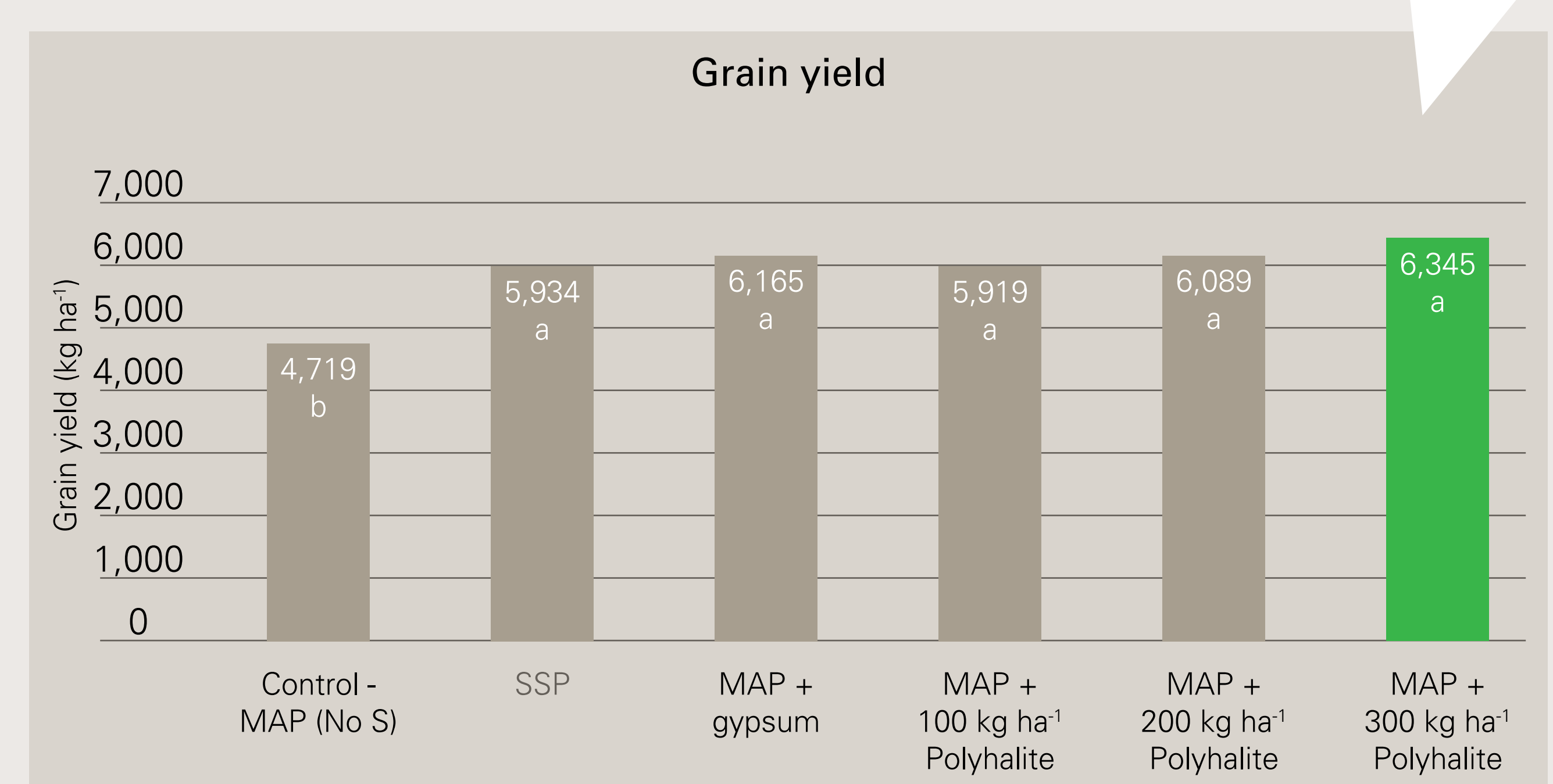
- The site cropped to wheat was sown under no-till on June 16, 2016, with a Klein variety at a density of 278 seeds m^{-2} .
- Fertilizers were applied in the seed line with a planter.
- At sowing, 167 kg of urea was applied broadcast. Nitrogen (N) at 75 $kg N ha^{-1}$ was applied as urea, prior to emergence on June 29, 2016.
- **Evaluations**
 - Grain was harvested mechanically on December 10, 2016, and yield converted to $kg ha^{-1}$ of grain.
 - Grain samples were taken for testing for commercial quality, which included hectoliter weight, protein and gluten content.

Conclusions

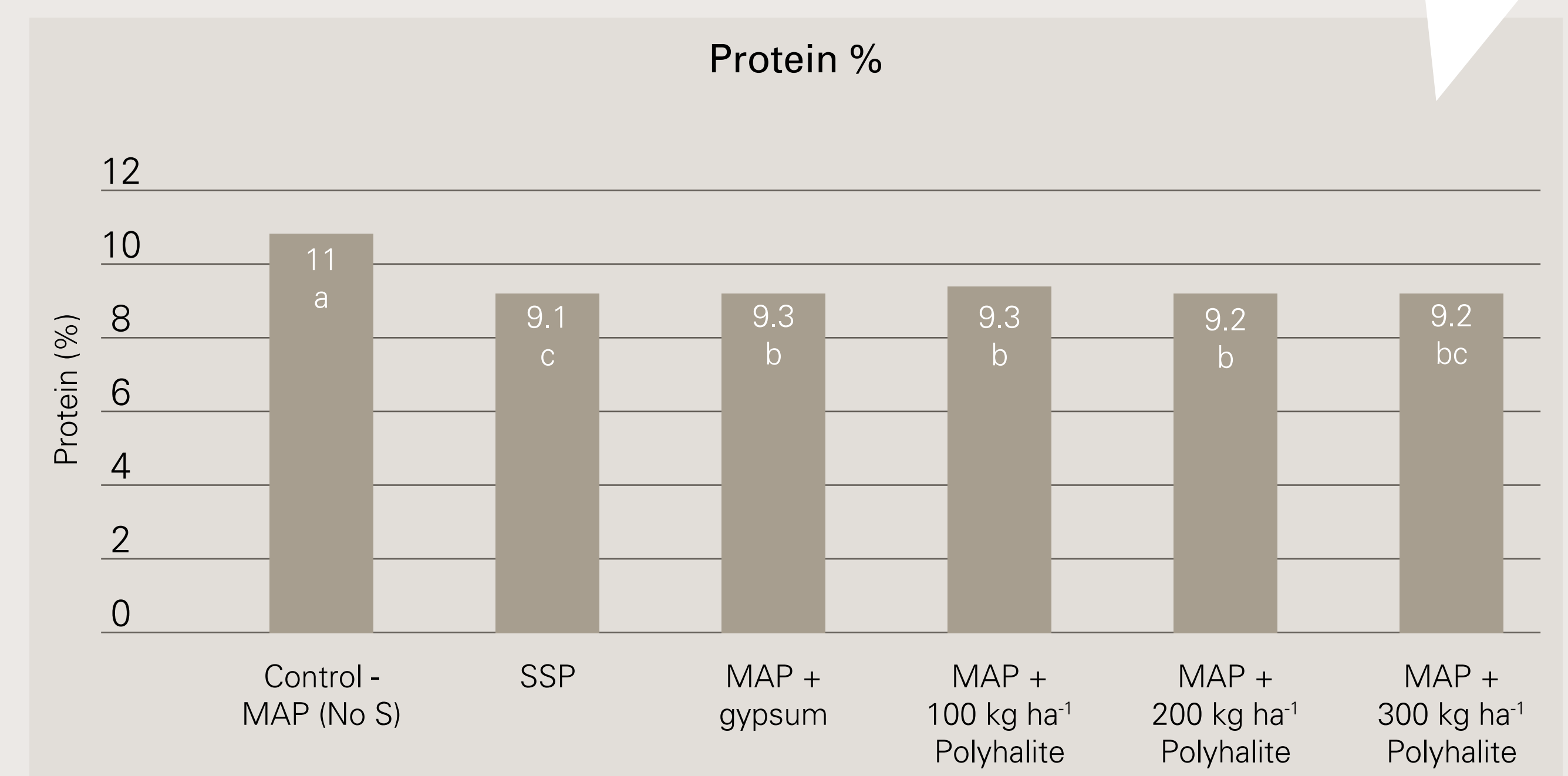
- The results highlight the importance of S in improving wheat yields in Argentina.
- This nutrient should not be lacking in the productive approaches used in the region.
- A rate of 19 $kg S ha^{-1}$ was sufficient to achieve a yield response.
- Polyhalite was an efficient source for supplying sulphur for wheat fertilization in Argentina.

Results and discussion

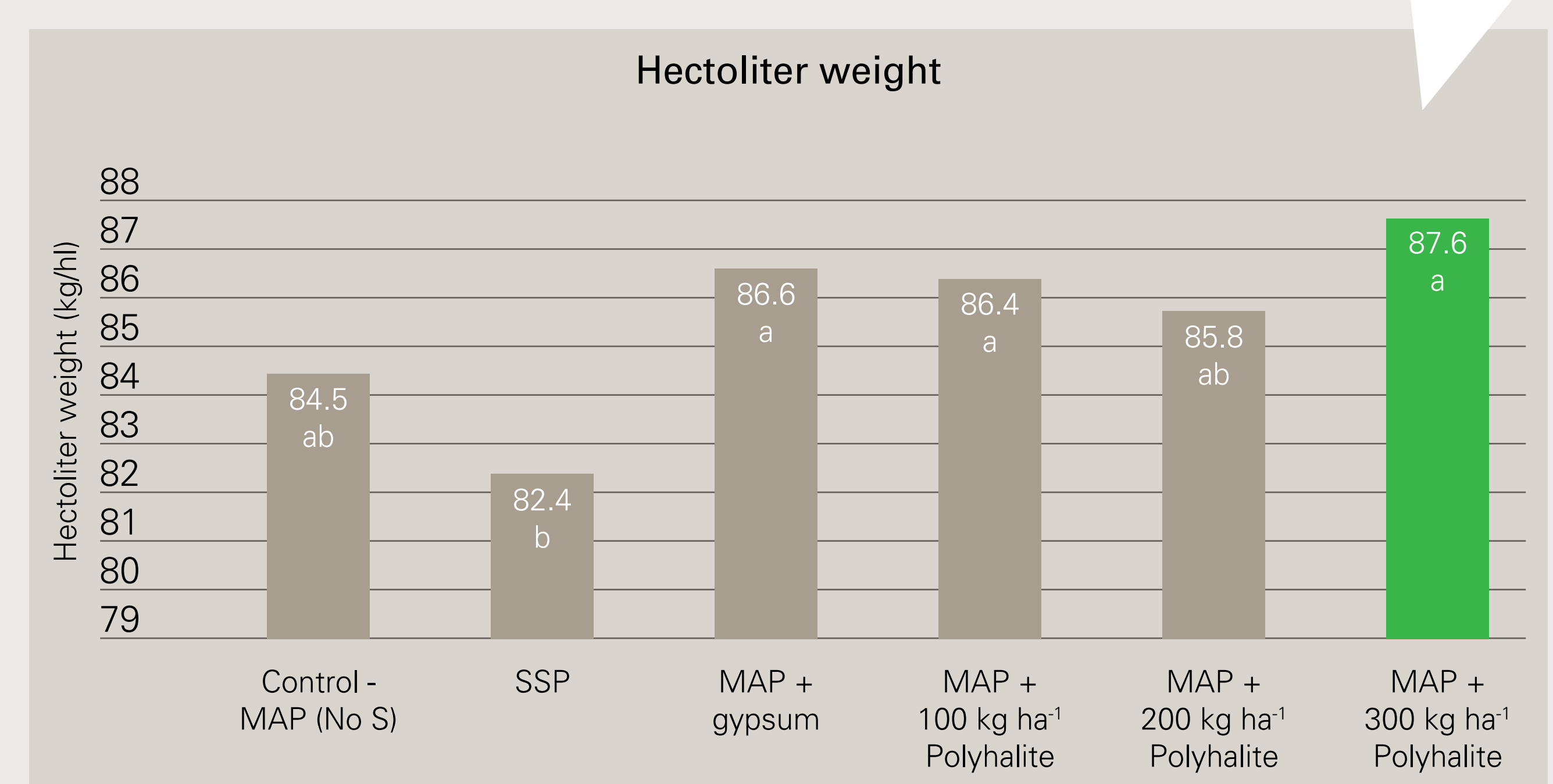
Significant response to S.
No significant response to K, Ca or Mg.



Protein values obtained were low. The only treatment that reached the commercial base was the control (11%). The level of N fertilization was probably lower than necessary.



Greater hectoliter weight = greater yield of flour.
Commercial standards require a value of 79 or higher.
There were statistical differences and SSP resulted in the lowest.



Different letters within columns indicate statistically significant differences.