EurAsian Journal of BioSciences
EurAsia J BioSci 2, 12, 102-109 (2008)

Studies on the efficacy of sulphate of potash (SOP) on the physiological, yield and quality parameters of banana cv. Robusta (Cavendish- AAA)

Alagarsamy Ramesh Kumar*, Neelakandan Kumar

Department of Fruit Crops, Horticulture College and Research Institute,
Tamil Nadu Agricultural University Coimbatore- 641 003, TN, India.

*Corresponding author: rameshort@yahoo.com

Abstract
The investigation was carried out to assess the comparative efficacy of sulphate of potash (SOP) and muriate of motash (MOP) to improve the growth, yield and quality of the Robusta banana through enhanced physiological processes. The chlorophyll content, relative water content, NRase activity, soluble protein, photosynthetic efficacy and gas exchange characters were found to be higher with 150 per cent of the recommended potassium (K) using SOP. The treatment T9 i.e. potassium application at the 150 per cent level as sulphate of potash had a higher total dry matter production, reflecting on the maximum bunch weight coupled with quality. The results clearly indicated the benefit of SOP in increasing the bunch size with better quality fruits, and hence it is recommended to integrate SOP in banana nutrition, by supplying a recommended dose of K through SOP at 2, 4, 6 and 8 months after planting.

Keywords: Banana, physiological parameters, quality, source of potassium, sulphate of potash, yield.

Kumar AR, Kumar M (2008) Studies on the efficacy of sulphate of potash (SOP) on physiological, yield and quality parameters of banana cv. Robusta (Cavendish- AAA). EurAsia J BioSci 2, 12, 102-109.
www.ejobios.com/content/2/12/102-109

INTRODUCTION

The banana requires more potassium for its growth, production and quality compared to nitrogen and phosphorus. With bananas, being a potassium loving crop, the farmers in India are applying potassium at 800 to 1600 kg per ha depending upon the available soil K status. As Muriate of Potash (MOP) is commonly used as the source of potassium, chloride toxicity is often seen in bananas, hindering the crop growth, yield and quality (Nalina 2002). Next to potassium, sulphur is considered as the fourth important nutrient, as bananas require 17 kg/ha/year (Walmsley and Twyford 1976). Sulphur (S) is crucial for the formation of amino acids like methionine and cystine, which are involved in protein synthesis. It is also associated with the synthesis of vitamin B, such as, biotine and thiamine, metabolism of carbohydrates, proteins and oils, formation of flavour imparting compounds and marketing quality of several crops. During recent years, due to intensive agriculture and use of sulphur free fertilizers, there has been a steady decline in the sulphur status of soils leading to its deficiency, which has become more pronounced and widespread throughout India (Rajagopalan 1985). In this context, fertilizers containing sulphur such as Sulphate of Potash (SOP), having K and S would be more useful (Zhao et al. 1999). However, the effect of SOP as a source of K in banana nutrition under Indian conditions has been rarely tested. With these backgrounds, an investigation was initiated at the Department of Fruit Crops, TNAU, Coimbatore to study the efficacy of SOP on growth, yield and the quality of banana cv. Robusta (AAA) as compared to MOP.

Received: June, 2008
Accepted: November, 2008
Printed: December, 2008

MATERIAL AND METHODS

The experiment was conducted at the College Orchard, Department of Fruit Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore using a Randomized Block Design (RBD) with 12 treatments and three replications in the year 2005. Each experimental treatment consisted of 16 plants. Guard rows were provided on all sides of the plot. The treatment details of the experiment are shown below:

Treatment details

T1 = No potassium (Control)

T2 = 100% of RDK through MOP (3rd, 5th, and 7th months after planting)

T3 = 100% of RDK through MOP (3rd, 5th and 7th months after planting) + magnesium (Mg) (30 g plant-1)

T4 = 100% of RDK through SOP (3rd, 5th, and 7th months after planting)

T5 = 100% of RDK through SOP (3rd, 5th and 7th months after planting) + Mg (30 g plant-1)

T6 = 100% of RDK through MOP (3rd and 5th months after planting) + SOP (7th month after planting)

T7 = 100% of RDK through MOP (3rd month) + SOP (5th and 7th months after planting)

T8 = 150% of RDK through MOP (2nd, 4th, 6th & 8th months after planting)

T9 = 150% of RDK through SOP (2nd, 4th, 6th & 8th months after planting)

T10 = 50% of RDK through MOP (2nd & 4th months) + 50% of RDK through SOP (6th & 8th months after planting)

T11 = 75% of RDK through SOP alone (3rd, 5th, and 7th months after planting)

T12 = 50% of RDK through SOP alone (3rd, 5th, and 7th months after planting)

Note:

1. RDK- Recommended Dose of K and hereafter it will be referred as RDK.
2. The recommended K adopted was 330 g per plant per year.
3. Wherever there were 3 and 4 splits involved, RDK was applied in three and four equal split doses respectively.

Besides, all the treatments received a recommended fertilizer dose of 110 g of nitrogen (N) and 35 g of phosphorus (P) per plant per year. Nitrogen was applied as urea in three splits (for treatments T1 to T7 and T11 & T12) in the 3rd, 5th and 7th months after planting and in four splits (for treatments T8 to T10) in the 2nd, 4th, 6th and 8th months after planting along with a K source. P2O5 was applied as a single super phosphate only in a single dose at the 2nd month after planting (for treatments T8 to T10) and at the 3rd month after planting (for treatments T1 to T7 and T11 & T12). The physiological parameters were recorded at the harvest stage and were dry matter production, chlorophyll contents, relative water content (RWC), nitrate reductase (NRase), soluble protein, catalse, peroxidase, photosynthetic efficiency, stomatal conductance, stomatal resistance, crop growth rate (CGR), relative growth rate (RGR) and absolute growth rate (AGR) (Watson 1958, Williams 1946, Kvet et al. 1971). The yield parameters studied were bunch weight, number of hands, total number of fingers, finger length, finger circumference, finger weight and pulp: peel ratio. The different quality attributes considered for the investigation were total soluble solids (TSS), acidity, ascorbic acid, reducing sugars, non-reducing sugars, total sugars and sugar/ acid ratio. The TSS was determined by using the Carl-Zeiss Hand Refractometer and the results were expressed in percentage. The titrable acidity was estimated by adopting (Anonymous, 1960) and expressed in terms of malic acid equivalents in percentage. The ascorbic acid content was estimated using 2, 6, dichlorophenol indophenol dye and expressed as mg of ascorbic acid per 100 g fresh fruit (Freed 1966). The total, reducing and non-reducing sugars were estimated as per the method suggested by Somogyi (1952) and expressed in percentage. The ratio was computed by dividing the total sugars by the acidity.

RESULTS AND DISCUSSION

Physiological parameters

The biomass accumulation and its distribution in various plant parts play a vital role in determining the production in banana. The dry matter production is one of the reliable measures for judging the optimum plant growth, besides it elucidates the pattern of distribution and redistribution of biomass between different plant parts at various stages of growth. In the present investigation, the differences among the different treatments were statistically significant. At harvest stage, the treatment T9 recorded the highest dry matter which was on par with all other treatments excepting T1 and T12. This indicated that the nutrients seem to be readily and sufficiently available for the crop growth in these treatments relatively in larger quantity. This could be possible due to increased nutrient uptake and better translocation of nutrients. Another possible explanation for increased dry matter production (DMP) is due to the role of sulphur contained in SOP, which normally enhances the starch accumulation and better protein synthesis (Singh and Trehan 1988). Further, the high DMP recorded in this study may be due to efficient synthesis and translocation of photosynthates as confirmed by the studies on the photosynthetic rate made in the present investigation (Table 1).

High photosynthetic activity is a good indication of physiologically efficient plants. This primarily depends upon the leaf chlorophyll content. Any nutrient management practice should aim in keeping the physiological parameters at maximum level, so that they will reflect on biomass production and yield. Significant differences among the treatments were noticed for chlorophyll 'a' content over different stages of crop growth. Irrespective of the growth stages in both the sites, T9 recorded the highest content. The different levels and sources of potassium exerted profound effect on the chlorophyll 'b' content of the leaves. At harvest stage, the treatment T9 was found to be the best treatment which was significantly different from the rest of the treatments. The total chlorophyll content of the leaves differed significantly and at the harvest stage and T9 recorded the highest value for total chlorophyll which was however on par with T4 and T8. Among the two sources, SOP was found to enhance the chlorophyll content in leaves when compared to MOP. Besides, with increased levels of SOP, there was an increase in the chlorophyll content. Sulphur is involved in chlorophyll synthesis, thus, resulting in an increased chlorophyll content in the leaves. The higher chlorophyll contents, observed in SOP applied treatments reflected on higher photosynthetic activities culminating in a higher biomass and yield. This could be possible because of the role of K in the synthesis of precursor of chlorophyll pigments. The higher chlorophyll content in leaves improves the transfer of radiation energy into primary chemical energy in the form of ATP and NADPH in the chloroplasts. Singh (1988) reported that sulphur application increased the activities of iron containing enzymes and K promotes the synthesis of catalase and peroxidase. Further, these enzymes are capable of scavenging the free radicals produced in the plant system and thus improving the general health of the

Table 1. Effect of Sulphate of potash on different physiological parameters of bananas.

Treatment	Dry matter production (g plant^{-1})	Chlorophyll 'a' (mgg^{-1})	Chlorophyll 'b' (mgg^{-1})	Total chlorophyll content (mg g^{-1})	Relative water content (%)	Nitrate reductase activity (μg/g/h)	Soluble protein (mg/g)	Catalase (units min^{-1} g^{-1} fresh weight)	Peroxidase (units min^{-1} g^{-1} fresh wt)
T_1	7255.62	0.711	0.351	1.111	77.18	775.81	39.80	67.20	40.43
T_2	8489.23	0.709	0.355	1.125	78.83	790.98	40.81	66.40	46.42
T_3	8526.4	0.731	0.361	1.130	78.90	798.84	40.62	65.00	49.30
T_4	8625.45	0.770	0.369	1.225	82.13	810.15	41.81	76.00	58.20
T_5	8500.2	0.763	0.370	1.173	82.01	804.82	41.68	65.20	44.60
T_6	8399.25	0.744	0.350	1.000	79.18	785.85	40.65	66.00	45.21
T_7	8410.25	0.740	0.357	1.193	79.01	790.90	40.73	66.50	44.45
T_8	8886.31	0.769	0.451	1.223	85.15	810.68	48.13	68.00	46.72
T_9	8925.54	0.780	0.501	1.281	87.13	825.25	50.18	77.30	60.50
T_{10}	8426.33	0.777	0.384	1.198	79.18	801.10	41.81	63.40	46.12
T_{11}	8025.21	0.743	0.391	1.201	79.01	795.58	41.18	63.80	45.54
T_{12}	7936.99	0.740	0.461	1.128	79.01	790.90	41.01	62.20	44.12
S.Ed	334.30	0.018	0.007	0.038	1.29	6.65	1.37	2.59	2.08
CD(p= 0.05)	693.40	0.037	0.015	0.078	2.68	13.79	2.84	5.38	4.32

plants, which is not possible by the use of MOP. Sulphur, present in the SOP, might be responsible for the formation of ferridoxin (iron - sulphur protein) in plants which might have a direct impact in activating the catalase and peroxidase enzymes. Presence of sulphur in SOP has a synergistic effect with zinc, which is essential for carbon dioxide absorption and utilization, synthesis of RNA and auxin. Zinc is also essential for chlorophyll formation, which improves the photosynthetic activity (Pandey and Sinha 1999).

Maintenance of optimum moisture content in the leaves is measured normally by relative water content and is highly influenced by the application of K in various proportions as observed in the present study. A close observation of the RWC obtained in the current study revealed that RWC increased with an increase in the levels of K, thus signifying the role of K in stomatal regulation. Accumulation of potassium in the cells leads to an increase in osmotic pressure, which in turn increases the turgor pressure of the cell. The osmotic pressure and turgor have a dominant role in the opening and closing of the stomata, which regulate the transpiration of water and the penetration of atmospheric carbon dioxide into the leaf. By regulating the stomata, excessive water loss through transpiration is prevented and thus K improves the water use efficiency (Table 1).

In the present investigation, though the maximum NRase activity was observed with 150 per cent of RDK supplied through SOP, the other treatments, namely the supply of 150 per cent of RDK through MOP or 100 per cent of RDK through SOP also triggered the maximum NRase in the majority of growth stages. Since nitrate reductase is the key enzyme of nitrate assimilation, the maintenance of the high rate of enzyme activity is imperative for enhanced protein content of the plants. The role of the K^+ ion in this enzyme activity was stressed by Evans and Solger (1966). Soluble protein is considered as an indirect measure of RuBP carboxylase activity as the enzyme constitutes more than 60 per cent of the soluble protein content, and hence, it serves as an indicator of the photosynthetic rate (Evans et al. 1975). RuBP carboxylase, the prime enzyme of carbon fixation is dominant the in soluble protein fraction of leaves and therefore is known as the most abundant protein in the world (Noggle and Fritz 1986). In the present study, soluble protein content was at its maximum with 150 per cent of RDK through SOP.

Yield and yield components

Yield in bananas is a function of bunch weight and number of plants per hectare. Hence, any nutrient management study should aim at producing maximum bunch weight, so that, the productivity could be enhanced reasonably. In the present study, application of potash fertilizers exerted positive influence on yield and yield attributes like number of hands, total number of fingers, finger weight, length and circumference. The highest yield was obtained with 150 per cent of RDK as SOP in four splits (T9). Further, it is interesting to note that the supply of 100 per cent of RDK through SOP (T4 or T5) had also produced significantly superior bunches on par with T9 indicating that the K level at 100 per cent through SOP was equally effective as that of 150 per cent SOP. Besides, the supply of 100 per cent of RDK through the combination of MOP and SOP indicated that with more the percentage of SOP, that the bunch weight was higher, further highlighting the beneficial role of sulphur in banana nutrition. Studies conducted elsewhere also revealed the beneficial role of S nutrition in enhancing bunch weight in bananas (Martin-Prevel 1972). The increase in bunch weight was also associated with the corresponding significant increase in the number of hands, total number of fingers, finger weight, length and circumference and pulp: feel ratio (Table 2). The favourable influence of SOP as compared to MOP on the production of heavier bunches might be attributed to the heavier dry matter and starch accumulation and additionally promoted by the sulphur present in SOP. The influence of sulphur in enhancing fruit yield in bananas was stressed by Lahav and Turner (1983).

It is further interesting to observe that for the same level of potassium, with two

Table 2. Effect of sulphate of potash on the yield parameters of the bananas.

Treatment	Bunch weight (kg)	No. of hands	Total no. of fingers	Finger length (cm)	Finger circum ference (cm)	Finger weight (g)	Pulp: peel ratio
T_1	26.84	8.63	165.56	19.74	13.30	171.31	2.91
T_2	27.08	9.33	171.83	20.02	13.54	185.15	3.11
T_3	27.75	9.33	170.14	19.81	13.50	180.50	3.08
T_4	29.04	9.88	175.58	20.94	13.68	198.18	3.29
T_5	29.00	9.88	173.14	20.68	13.63	193.25	3.20
T_6	27.18	9.33	169.38	19.98	13.55	188.28	3.09
T_7	28.68	9.88	173.14	20.08	13.58	189.28	3.10
T_8	28.85	10.00	180.36	21.34	13.83	202.15	3.38
T_9	29.84	10.35	185.28	21.83	14.10	208.30	3.58
T_{10}	28.31	9.50	173.18	20.33	13.64	185.43	3.18
T_{11}	27.18	9.33	170.14	20.03	13.44	180.18	3.15
T_{12}	27.10	9.33	170.14	20.00	13.40	179.81	3.10
S.Ed	0.83	0.23	6.66	0.11	0.29	5.49	0.10
CD (p= 0.05)	1.73	0.48	13.82	0.22	0.61	11.39	0.21

sources of K, SOP was found to be superior to MOP. In SOP, sulphur is present in the form of sulphate which is water soluble and hence, needs no further transformation in soil for the plants to absorb it. Further, the solubility of SOP per se is higher than MOP. Another plausible explanation for a higher yield with SOP is due to its role of a synergistic effect with other nutrient elements. Sulphur can increase the absorption of potassium or it can react with nitrogen and potassium (Farrag et al. 1990). Sulphur helps in energy transformation and activation of enzymes in carbohydrate metabolism and subsequently greater partitioning of photosynthates in yield attributes. Sulphur application increased the yield since it is a constituent of amino acid and protein production (Ahmed et al. 1998). Another reason for higher yield with SOP was due to the absence of chloride toxicity which is normally met with MOP.

Growth analysis is necessary to understand the plant growth in quantitative terms and to interpret crop yields under different nutrient levels. In the present study, growth analysis was worked out between 5 months after planting (MAP) to the shooting stage. The results revealed that the treatments containing SOP (T9 and T4) recorded the maximum crop growth rate (CGR), relative growth rate (RGR), and absolute growth rate (AGR) from 5 MAP to shooting (Table 3). All these would have led to higher photosynthetic efficiency reflecting on higher dry matter production, which inturn would have helped in getting higher yields (Gardner et al. 1988).

Fruit quality

In a high value crop species like banana,

Table 3. Effect of sulphate of potash on the photosynthetic and plant growth parameters of bananas.

Treatment	Photosynthe tic efficiency (μ mol/m^2/S)	Stomatal conductance (mmol/m^2/S)	Stomatal resistance (mmol/m^2/S)	Crop growth rate (CGR) (gm^{-2} day^{-1})	Relative growth rate (RGR) (g g^{-1}day^{-1})	Absolute growth rate (AGR) (g plant^{-1})
T_1	2.45	1.433	8.14	4.93	0.00226	15.96
T_2	2.83	1.560	8.23	5.67	0.00252	18.36
T_3	3.01	1.610	8.53	5.63	0.00251	18.24
T_4	3.33	1.890	7.76	6.16	0.00269	19.95
T_5	3.35	1.917	8.33	5.94	0.00260	19.24
T_6	2.91	1.650	8.34	5.84	0.00259	18.91
T_7	2.99	1.687	8.38	5.88	0.00261	19.06
T_8	3.57	1.973	8.77	5.72	0.00252	18.55
T_9	3.65	2.023	7.56	6.55	0.00285	21.22
T_{10}	3.07	1.653	8.68	5.47	0.00242	17.71
T_{11}	3.29	1.730	8.97	5.67	0.00252	18.38
T_{12}	3.17	1.693	8.68	5.61	0.00250	18.17
S.Ed	0.10	0.07	0.20	0.09	0.00001	0.78
CD (p= 0.05)	0.21	0.14	0.42	0.19	0.00002	1.62

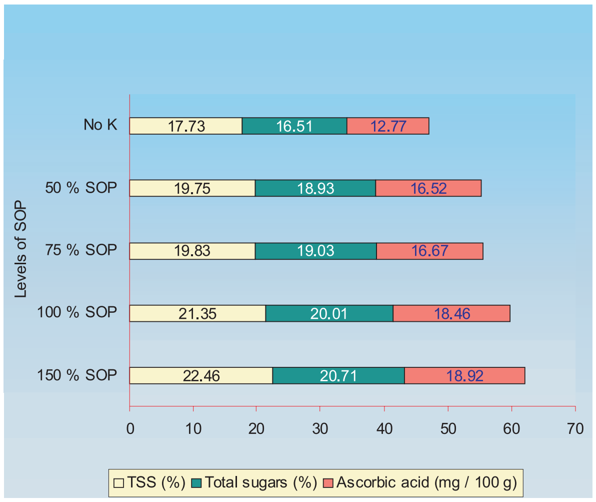

Fig. 1. The influence of varying levels of SOP on quality traits.

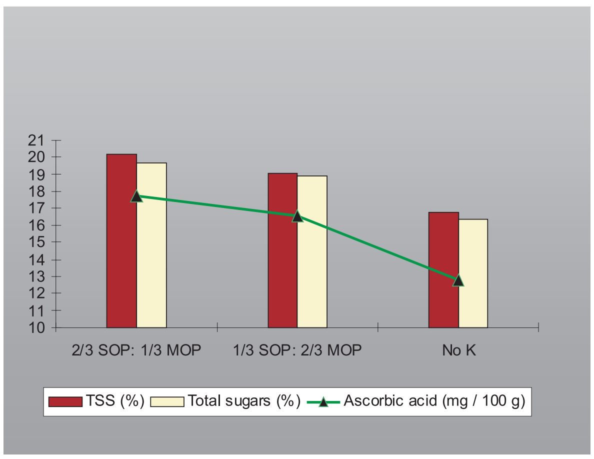

Fig. 2. The influence of the combination of sources of potassium (SOP: MOP) on the quality traits.

quality standards have become the most important factor influencing a monetary yield and farmer's income. In bananas, fruit quality is mainly judged by the sugar content and acidity in the pulp. A marked effect on fruit quality was observed in the present study due to varying levels and sources of potassium. With the increase in the levels of K, the quality parameters like TSS, reducing sugars, non-reducing sugars, total sugars and ascorbic acid increased, while the acidity decreased. SOP at the 150 per cent level was found to be superior in registering higher values for various quality parameters, with concomitant lower acidity. Higher fruit quality especially higher sugar content can be explained by the role of potassium which is involved in carbohydrate synthesis, breakdown and translocation and synthesis of protein and neutralization of physiologically important organic acids (Tisdale and Nelson 1966). Besides, K is involved in phloem loading and unloading of sucrose and amino acids and storage in the form of starch in developing fruits by activating the enzyme starch synthase (Mengel and Kirkby 1987).

Further, a perusal of the results revealed in the present study that 100 per cent of RDK through SOP produced quality fruits as that of 150 per cent of RDK through SOP. However, its effect was drastically reduced at the 75 per cent and 50 per cent level. Similarly, when K was applied through SOP and MOP, it was obvious that T7 i.e. 2/3rds of K through SOP was better than 1/3rd or 1/2 through SOP, signifying the role of S in improving the quality of fruits. Enhanced quality of fruits particularly the sugar content may be due to the role of SO4 ions released from SOP as sulphate favours, while chloride reduces, the activity of anabolic enzymes, resulting in accumulation of highly polymerized carbohydrates (starch), which would have subsequently disintegrated into sugars on ripening. Apart from the higher sugar content with a higher level of K wherever SOP was applied, there was increased ascorbic acid content in the fruits. Potassium and sulphur could have helped to slow down the enzyme system that encouraged the oxidation of ascorbic acid, thus helping the plants to accumulate more ascorbic acid content in the fruits (Ananthi 2002).

Increased level of K application results in reduced acid content of fruits. This could be due to the fact that under low K regime, phosphoenol pyruvate (PEP) was apparently shunted into alternate pathways resulting in a shortage of acetyl CO-A (Pattee and Teel 1967). Hence, oxalo acetate appeared to be preferentially formed from PEP in plants with low levels of K and this organic acid derivative accumulated. Neutralization of organic acids due to a high K level in tissues could have also resulted in the reduction in acidity (Tisdale and Nelson 1966).

ACKNOWLEDGEMENT

The authors wish to acknowledge the financial assistance offered by M/S. Kali and Salz, Germany to execute a research project in this line of work.

REFERENCES

Anonymous (1960) Official methods of analysis. A.O.A.C, Washington D.C.

Ahmed MK, Aditya DK, Siddique MA (1988) Effect of N and S application on the growth and yield of onion cv. Faridpur Bhatti. Bangaldesh Horiculture 16, 1, 36-41.

Ananthi S (2002) Comparative efficacy of sulphate of potash and muriate of potash on yield and quality of chilli (*Capsicum annuum* L.) M.Sc Thesis, Tamil Nadu Agricultural University Coimbatore-3, TN, India.

Evans HT, Sorger GJ (1966) Role of mineral elements with emphasis on the univalent cations. Annual Review P1ant Physiology 17, 47-76.

Evans LT, Wardlaw KP, Fisher RA (1975) Crop Physiology. Cambridge University Press, London.

Farrag AA, Shehata, AA, Kandil MM (1990) The effect of phosphorus and sulphur fertilizers on seed protein of broad bean plants. In: Proceedings Middle East Sulphur Symposium, 12-16 February, 1990, Cairo 361-371.

Freed M, (1966) Methods of vitamin Assay. International Science Publishers, New York.

Gardner FP, Brent Pearce R, Mitchell RL (1988) Physiology of Crop Plants. Scientific Publishers, Jodhpur.

Kvet J, Ondok JP, Necas J, Jarvis PG (1971) Methods of growth analysis. In: Sestak Z, Catsky J, Jarvis PG (eds.), Plant Photosynthetic Production: manual and methods, Dr. W. Junk N.V. Publishers, The Hague, 343-391.

Turner DW (1983) Banana nutrition. IPI-Bulletin No.7. International Potash Institute, Bern.

Martin-Prevel P (1972) Banana. In: Wichman W (ed), World Fertilizer Use Manual, International Fertilizer Industry Association, Paris, 398-409.

Mengel K, Kirkby EA (1987) Principles of plant nutrition. International Potash Institute, Bern.

Nalina L (2002) Standardization of fertilizer requirement for tissue cultured banana cv. Robusta (AAA). Ph.D Thesis, Tamil Nadu Agricultural University Coimbatore.

Noggle GR, Fritz GJ (1986) Introductory plant Physiology. Prentice Hall of India. Private Ltd., New Delhi.

Pandey SN, Sinha BK (1999) Plant Physiology. Vikas Publishing House Private Ltd., New Delhi.

Pattee HE, Teel MR (1967) Influence of nitrogen and potassium on variation in content of malate, citrate and malanate in non-nodulating soybeans (*Glycine max*). Agronomy Journal 59, 187-189.

Rajagopalan V (1985) Nutrient sulphur. In: Proceedings of TNAU-FACT National seminar on sulphur in agriculture, 18-19 October 1985, TNAU, Coimbatore, 1-4.

Singh HG (1988) Sulphur management in fine textured calcareous soils. In: Proceedings of TSI - FAI Symposium, 9-10 March 1988, New Delhi, 2-8.

Singh JP, Trehan SP (1988) Balanced fertilization for improving crop productivity. In: Brar MS, Bansal SK (eds), Proceedings of balanced fertilization in Punjab Agriculture, Ludhiana, 129-139.

Somogyi N, (1952) Notes on sugar determination. Journal of Biological Chemistry 200,145-154.

Tisdale SL, Nelson WL (1966) Soil fertility and fertilizers. Macmillan Co., London.

Walmsley D, Twyford IT (1968) The uptake of P32 by the 'Robusta' banana. Tropical Agriculture Trinitad 45, 223-228.

Watson DJ, (1958) The dependence of net assimilation rate in leaf area index. Annals of Botany 22, 37-54.

Williams RF, (1946) The physiology of plant growth with special references to the concept of net assimilation rate. Annals of Botany 10, 41-72.

Zhao FJ, Wood AP, McGrath SP (1999) Effects of sulphur nutrition on growth and nitrogen fixation of pea. Plant and Soil 212, 2, 207-217.

Potasyum Sulfat'in, Robusta (Cavendish-AAA) Muz Kulturunde Fizyoloji, Urun ve Kalite Parametreleri Uzerine Etkileri Hakkinda Calismalar

Ozet

Calisma, fizyolojik surecler araciligiyla potasyum sulfat ve potasyum hidroklorit'in Robusta muzunda buyume, urun ve kaliteyi iyilestirme konusunda karsilastirmali etkilerini incelemek amaciyla gerceklestirildi. Potasyum sulfat araciligiyla, tavsiye edilen K'un yuzde 150'si uygulandiginda; klorofil icerigi, nisbi su icerigi, NRaz aktivitesi, cozulebilir protein, fotosentetik etkinlik ve gaz degisim karakterlerinin daha yuksek oldugu goruldu. T9 uygulamasi, yani potasyum sulfat seklinde tavsiye edilen K'un yuzde 150'si, daha yuksek kuru madde uretimi gosterdi. Bu durum, bize kaliteyle birlikte maksimum hevenk agirligi gerceklestigini gostermektedir. Sonuclar, daha kaliteli meyvelerle birlikte hevenk buyuklugunu artirmada potasyum sulfat'in faydasini acikca gostermektedir. Bu yuzden, dikimden 2, 4, 6 ve 8 ay sonra, potasyum sulfat seklinde K uygulanarak muz besinine potasyum sulfat ilavesi tavsiye edilir.

Anahtar Kelimeler: Fizyolojik parametreler, muz, kalite, potasyum kaynagi, potasyum sulfat, urun.