

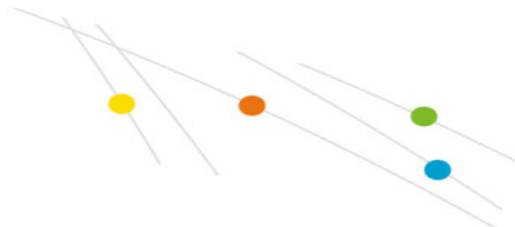


Two Ultrasol® Banana formulas in India well received by farmers following demonstration of increased yield and revenue

Banana is one of the leading fertigation crops grown in India. It is an affordable staple food of great socio-economic importance. Currently, a total of 3,3 million hectares in India is cultivated with crops using drip irrigation. Banana plantations occupy 0,38 million hectares of this total surface. Banana cultivar Grand Naine (G9) is the most popular variety grown in India. It is valued for its characteristic medium plant height (facilitating harvest) and large fruit yields.

Banana is a heavy consumer of fertiliser, especially potassium and nitrogen. Inappropriate use of fertilisers, emerging nutrient deficiencies, declining nutrient use efficiency, negative soil nutrient balance and depletion of organic matter in soil are the major challenges for banana growers India, preventing achievement of a profitable revenue. Potassium, sulphur, boron and zinc deficiencies are common in banana growing areas in India. Fertiliser application with the irrigation system is considered the most effective method of fertilisation. A good irrigation system facilitates accurate fertiliser application with precise dose and timing, without additional manual labour costs.

Scientifically designed trials showed that use of Ultrasol® Banana can result in an impressive and consistent improvement of 16-18% over farmers practice in fruit yield both scientific designed trials and farmer adoptions trials showed a consistent increase in fruit yield of 20% (+16 MT/ha) over farmers practice: increasing the net revenue with 30%. Return on investment was calculated based on farmers adoption trials and showed that an increase in yield of only 4,7% will justify the investment in



Ultrasol[®] Banana I and II.



Figure 1. Ultrasol[®] Banana Trial field visit and observation in Maharashtra state. From left to right 1. Dr Yogesh Kadam, Agronomist, CSQM, 2. Mr. Jitendra Kumar Singh, Manager-Technical & Business Development, CSQM, 3. Ing. Agr. M.Sc. Juan Fco. Palma M, Global Market Development Manager, SQM, 4. Mr. Neelesh Bhange, Farmer, 5. Mr. Dattatray Fere, Business Development Manager South Asia, SQM, 6. Mr. Prabhat Raghuvanshi, Manager, Consumer connect, Coromandel Int. Ltd, 7. Mr. Mahadev Suvarna, Sr AVP & Business Head, CSQM, 8. Mr. Suji Bhake, Sr. Zonal Manager, Marketing, Maharashtra, Coromandel Int. Ltd.

Understanding the previously mentioned challenges, SQM Coromandel (CSQM) has successfully developed two customized formulas for banana production in India, to enable stage-specific fertigation: Ultrasol[®] Banana I (13-12-26) during establishment and vegetative growth and Ultrasol[®] Banana II (10-5-36) during the reproductive growth stages (Figure 1 and Table 1).

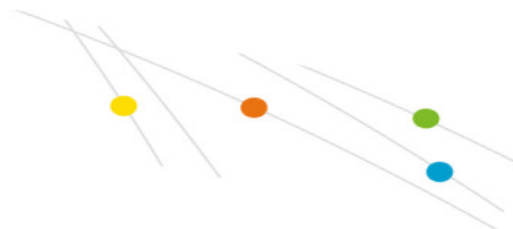


Table 1. Specifications and the recommended programme used in the adoption trials with the CSQM formulas in a fertigation programme for banana. The formulas contain chelated micronutrients: Zn EDTA, Fe EDDHA, Mn EDTA, Cu EDTA. A total of 800 kg/ha Ultrasol® Banana I and 500 kg/ha of Ultrasol® Banana II is recommended. Calcium is additionally provided by calcium nitrate applications in fertigation. Need for nitrogen can be balanced using urea.

Crop stage Etapa del cultivo	Days after planting Días después de plantación	Numbers of application Número de aplicaciones		Fertiliser source *with irrigation Fuente de fertilizante *con riego		Total application Aplicación total de la dosis (kg/ha)							
Soil application Aplicación en suelo	Basal	1		DAP (soil applied/aplicado al suelo)		188							
		1		SOP (soil applied/aplicado al suelo)		125							
Rooting to shooting (vegetative) Enraizamiento al brote (vegetativo)	15-180	24		Ultrasol® Banana I *		800							
		24		Urea *		625							
		9		Calcium Nitrate *		63							
		1		KCl (side dressed/cobertera)		375							
Bunch development to fruit development (generative) Desarrollo del racimo para desarrollo de fruta (generativo)	181-280	14		Ultrasol® Banana II *		500							
		14		Urea *		375							
		1		KCl (side dressed/cobertera)		188							
Total Nutrients (kg/ha) Total de nutrientes (kg/ha)	N-Total	N-NO ₃	N-NH ₄	N-NH ₂	P ₂ O ₅	K ₂ O	MgO						
	657	163	34	460	207	788	29						
	CaO	S	Fe	Mn	Zn	Cu	B						
	12	37	2,5	3,2	5,4	0,008	0,8						
Ultrasol® Banana stage-specific formula specifications (%)													
Formula	N-Total	N-NO ₃	N-NH ₄	N-NH ₂	P ₂ O ₅	K ₂ O	S	MgO	Zn	Fe	Cu	Mn	B
Ultrasol® Banana I	13	7	3	3	12	26	1,2	1,6	0,5	0,3	0,001	0,4	0,1
Ultrasol® Banana II	10	8,5	-	1,5	5	36	1,2	3,3	0,27	-	-	-	-

A second aim of the development was to make it easy for the farmer to prepare a balanced nutrient solution: the two Ultrasol® formulas reduce the need to handle many different generic formulas in traditional practice. The farmer profits from lower labour-costs and prevention of mistakes when mixing the nutrient solution.



Figure 2. UltraSol® Banana launching leaflet with UltraSol® Banana I (13-12-26) for establishment and vegetative development and UltraSol® Banana II (10-5-36) for the reproductive growth stages.

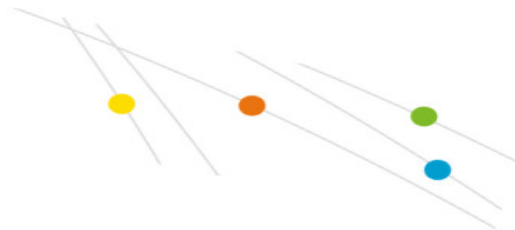
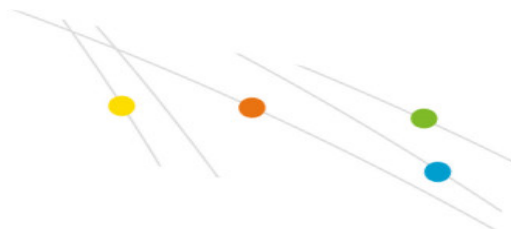


Figure 3. Ultrasol® Banana (right) improved pseudostem diameter and architecture to support development of heavy and high-quality bunches.



Figure 4. Ultrasol® Banana (right) improved the root system as compared to farmer practice.

As is custom for development at CSQM, two categories of trials were conducted: scientifically designed trials and adoption trials. Two scientifically designed field trials

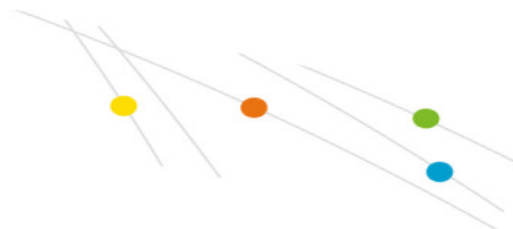


were laid out for product comparison and dose optimization. Additionally, six large scale adoption trials were organised to demonstrate product performance in commercial plantations in the states of Andhra Pradesh, Maharashtra, Gujarat and Karnataka. Field days were organised to showcase the benefits of Ultrasol[®] Banana at the trial locations.

The scientific trials were carried out in Maharashtra and Andhra Pradesh on c.v. Grand Nain. Progressive farmers, following drip fertigation practice, were selected for these trials. Their current practice served as the reference treatment. Three doses of the recommended fertiliser dose (RDF=700:180:800 kg NPK/ha) using Ultrasol[®] Banana I and II, were compared with treatments where only one of these Ultrasol[®] Banana stage-specific formulas replaced current farmers practice, and also compared with Coromandel Int. Ltd generic WS fertilisers recommendation for banana. In this IQ issue, we only present the results for the recommended commercial dose as was used in the farmer adoption trials (Table 1).



Figure 5. Benefit of Ultrasol[®] Banana I during vegetative growth. Comparing plant



development at 45 days after planting between the Ultrasol[®] Banana programme (T1) and the farmers practice (T6) in the scientifically designed trial in Maharashtra.

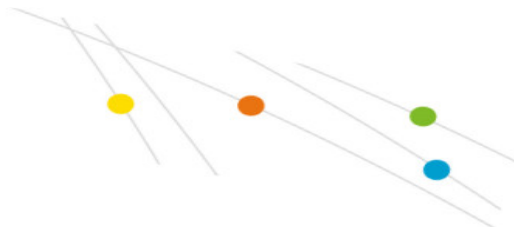
Table 2. Means, standard error (s.e.) and 95% confidence Interval (CD 0,05%) for various parameters measured in the two scientifically designed trials. Numbers are underlined for those parameters where the 100% of the recommended fertiliser dose with Ultrasol[®] Banana stage-specific formula's resulted in statistically significantly higher values compared to the farmers practice (FP).

State Estado	Treatments Tratamientos	Leaves/plant Hojas/plantas	Stem girth (cm) Circunferencia del tallo (cm)	Hands/bunch Manos/racimo	Fruits/hand Frutos/manos	Fruits/bunch Frutos/racimos	Fruits/length (cm) Largo del fruto (cm)
Andhra Pradesh	FP/FA	17	65	8	19	130	26
	Ultrasol [®] Banana	<u>20</u>	<u>71</u>	<u>10</u>	19	139	<u>30</u>
	s.e.	0,7	0,6	0,3	0,5	2,6	0,5
	CD (0.05%)	2,0	1,9	1,0	1,7	7,9	1,7
Maharashtra	FP/FA	13	51	5	25	130	-
	Ultrasol [®] Banana	13	55	<u>8</u>	<u>30</u>	150	-
	s.e.	0,1	1,4	0,3	0,7	4,0	-
	CD (0.05%)	0,4	4,4	0,8	2,0	12,3	-

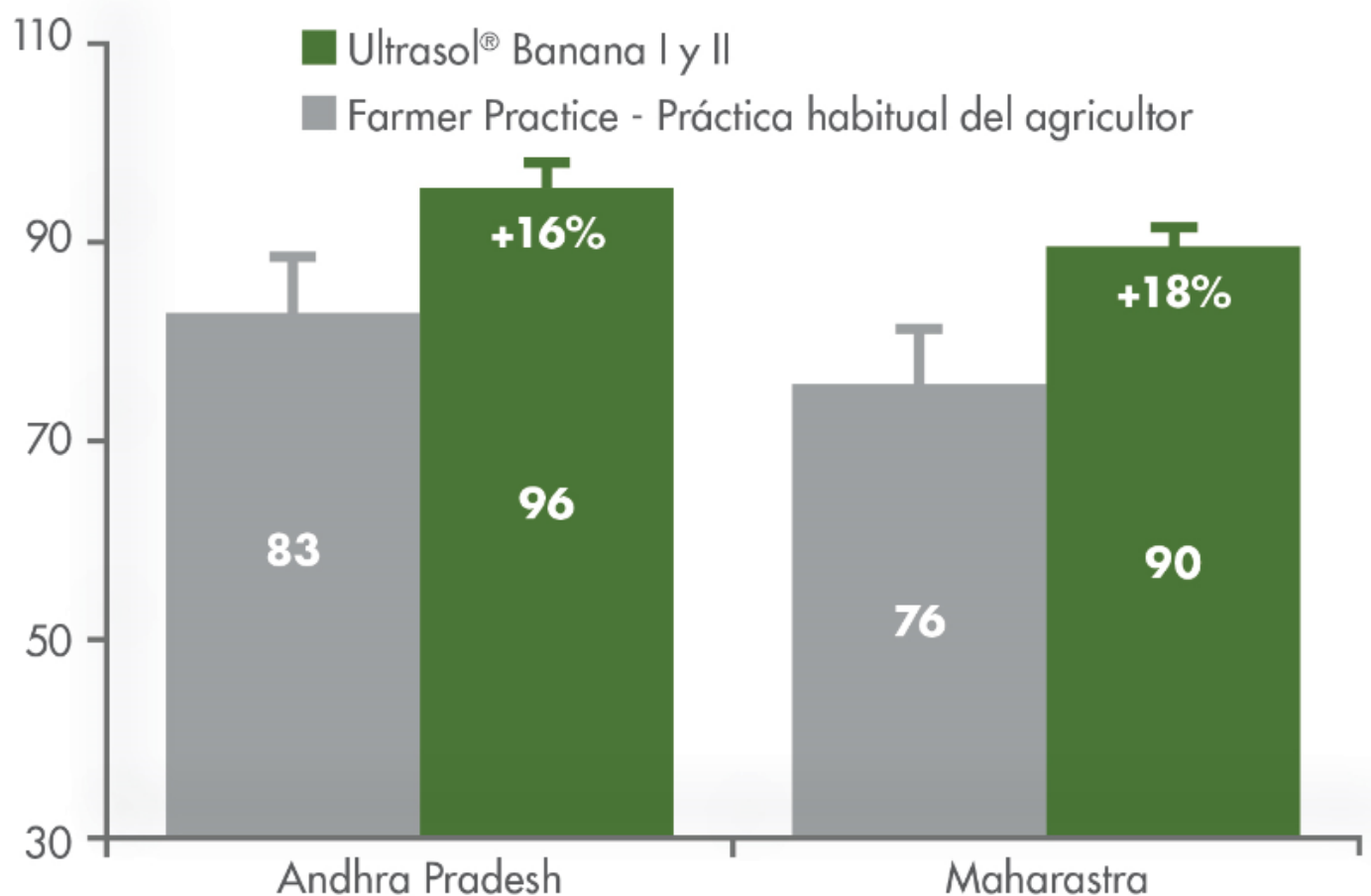
Figure 6. Ultrasol[®] Banana (right) improved fruit size, shape, fruit length, uniformity and increased market value with good tip filling and increased quality.



Figure 7. Yield results in both scientific trials in Andhra Pradesh and Maharastra. The programme with Ultrasol[®] Banana I and II at 100% of the recommended fertiliser rate increased yield with 16-18% compared to the farmers practice. Bars represent 95% confidence intervals of the means.

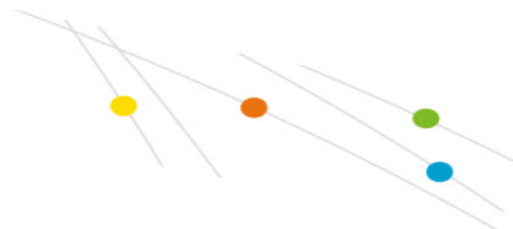


Yield (MT/ha)/Rendimiento (TM/ha)



Ultrasol® Banana I and II are designed to supply the crop with all the nutrients throughout the crop development, based on the needs of the crop. Additional to providing the optimal balance of nutrients, Ultrasol® Banana lowers the pH in the root zone which helps to improve availability of phosphates and certain trace elements and controls acidity of the tank mix (buffer solution) used for fertigation.

Table 3. Cost to benefit calculation for the CSQM programme based on Ultrasol® Banana in Banana. Average result of 4 adoption trials on Banana cultivar Grand Naine (G9) in Andhra Pradesh (AP), Maharashtra (MH) and Karnataka (KA).



Item	Unit/Unidad	Farmer practice Práctica habitual del agricultor	Ultrasol® Banana	Benefit of Ultrasol® banana Beneficios de Ultrasol® banana
Yield AP/Rendimiento AP	MT/ha	83	99	+16
Yield KA/Rendimiento KA	MT/ha	63	81	+18
Yield MH-1/Rendimiento MH-1	MT/ha	75	90	+15
Yield MH-2/Rendimiento MH-2	MT/ha	68	83	+15
Average Yield/Rendimiento promedio	MT/ha	72	88	+16 (23%)
Average Price received Precio promedio recibido	USD/MT	194	208	+14
Average Fertiliser cost Costo promedio del fertilizante	USD/ha	2 001	2 712	-711
Yield AP Rendimiento AP	USD/ha	14 039	18 385	+4 347
Net income/Ingreso neto	USD/ha	12 038	15 674	+3 636 (30%)
Break-even: extra yield in MT/ha (%), required to justify fertiliser cost Punto de equilibrio: rendimiento adicional en MT/ha (%), requerido para justificar el costo del fertilizante				+3,4 (4,7%)

Results highlights

Scientifically designed trials showed that use of Ultrasol® Banana can result in an impressive and consistent improvement of 16-18% over farmers practice in fruit yield (Figure 7). This is mainly due to a higher number of hands per bunch, bearing larger fruits (Table 2). Ultrasol® Banana stage-specific formulas also improve crop growth parameters such as pseudostem diameter and number of leaves, and an improved root systems (Figures 3-6, Table 2).

The higher yield was combined with more convenience for the grower when preparing the nutrient solution. Use of Ultrasol® Banana I and II can reduce the number of water soluble fertilizer products from between seven to eleven different sources in the farmers practice (at least urea, calcium nitrate, 19-19-19, MAP, 13-40-13, magnesium sulphate and potassium nitrate) to three in the CSQM programme (Ultrasol® Banana, urea and calcium nitrate). The crop also benefits from a constant and balanced ratio



of nutrients in the root zone, as opposed to the farmers practice where application of different fertilizer products with irrigation is alternated over different weeks.

The adoption trials showed how a greater yield translates into to economic benefit for the farmer (Table 3). In the Ultrasol[®] Banana plots, yields were 20%-29% higher to farmers practice and the farmers net income/ha increased by 25-35% by following the CSQM programme: the net benefit ranging from 3.200 to 4.000 USD/ha over the four adoption trials.

What's next?

Ultrasol[®] Banana I & II have been launched in India by CSQM in May 2018 and received very good response from farming community. The product is doing well, and a good volume of sales has already been realised.