nuts

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Nuts have played an important role in the human diet through the centuries. They can be divided into temperate climate species such as almonds, chestnuts, hazelnuts, pecan, pistachio and walnuts, while sub-tropical species include macadamias, cashews and Brazil nuts.

Almonds

The almond is related to stone fruit and, as native to Eurasia, has been cultivated for thousands of years. The seed contains amygdalin, a cyanide-producing compound, which gives the typical bitter almond taste and flavour.

READ ARTICLE

Chestnuts

This crop has four commercially-important species worldwide known as American, European, Chinese and Japanese chestnuts. However, due to chestnut blight that severely affected this crop, only the Japanese chestnut remains commercially important in the USA. The chestnut has the unique feature of being eaten without much drying.

Hazelnuts

These nuts, also called Filberts or cob nuts, are native in the northern temperate zones. Only the European species is commercially cultivated and is mostly ground into a powder form used to flavour sweets and ice-cream, or to produce a nut paste. Most hazelnut production is in Oregon, USA.

READ ARTICLE

Pistachio

The pistachio is native to the eastern Mediterranean area and parts of Asia, and has been cultivated for over 3000 years. It is mainly used as salted nuts, or as flavourant in ice-cream, cakes and nougat.

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Pecan

The nut is classified together with walnuts into the Walnut family and is related to hickory nuts and butternuts. It is native to Mexico and southwest America and currently has more than 300 listed varieties.

Walnut

Two types of walnuts are found, the lesser-known English walnut native to Europe and Asia and, most important commercially, the Black walnut native to North America. Walnuts are consumed as is, or in ice-cream and sweets, due to their strong taste.

Macadamia

The *Macadamia integrifolia* tree species is a member of the *Proteaceae* family and is native to the tropical regions of eastern Australia. Macadamias are currently cultivated worldwide and the nuts have become an important agricultural crop. Some cultivation problems include poor fruit set, specific climatic growing condition requirements and difficulties in shelling the very hard shells of these nuts.

READ ARTICLE

Cashew

Native to the forests of northern South America, these nuts are related to species such as poison ivy and mangoes. A unique feature of this crop is that the oil of the seeds and juice of the fruit may be used as an anti-plaque product for dental protection.

Brazil nut

The Brazil nut is native to the forests of South America, with most of the worldwide production still originating from wild trees. The nuts are borne in large wooden spheres weighing up to 2.5 kg each.

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Auxins and plant development

The most dominant effect of auxins on plants is the stimulation of lateral root development after treatment. Other improved responses from this group of hormones stated in the literature include improved cell division, cell enlargement, flower development, fruit set, set retention and size of fruits. One of the requirements for good fruit set is sufficient elongation of the pollen tube. Auxins are present in pollen and play an important role in pollen tube elongation. When natural levels of auxins in pollen are too low, the application of exogenous auxins will help to alleviate the problem and subsequently improve fruit set. These auxin response claims led to trials with Kelpak foliar spray programs on almonds, hazelnuts, macadamias and pistachios to evaluate the effect on general growth, nut set and quality, and total nut yield.

Kelpak as auxin source

Kelpak is a seaweed product, extracted from the species *Ecklonia maxima*, found only at the southern tip of Africa. The raw material itself contains high levels of natural auxins and these levels are maintained in the end product due to the unique pressure differential extraction method which has no negative effect on the delicate auxin molecules. Several different natural auxins have been identified in Kelpak, giving an average biological auxin activity equivalent to 11 mg indole butyric acid (IBA) via bioassay. Kelpak is unique as an auxin source, as the pure formulation has been approved for use in organic crop production according to the standards of the US National Organic Program (NOP), EEC Regulation 2092/91 and Biological Farmers of Australia (BFA).

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Macadamia

The first Kelpak trial on a nut crop was conducted on a commercial farm in Malawi where 120 trees were selected from each of six Macadamia clones. Six trees of each clone were left as controls, while Kelpak foliar sprays at 2 L/ha (2 pints/acre) were applied to six more trees of each clone. Kelpak was first applied on 1 June at a pre-bloom stage and repeated three more times at monthly intervals. All other management practices were the same throughout the trials. Visual evaluation during the growth season showed healthier leaves and more dense canopies on the treated trees, indicating improved vegetative growth. All Kelpak-treated trees by clone had higher harvest yields than the control, varying from a 17 to 35% increase over each control (Figure 1), suggesting better nut set and retention. The treated tree yields also produced a higher crack-out percentage than the control and, ultimately, a higher marketable return than the control.

This positive result was followed up by a statistical trial on a commercial farm in the sub-tropical Mpumalanga Region of South Africa. Two foliar treatment programs were evaluated. Kelpak applied at 0.2% (200 ml/100 L water) five times was compared to 0.3% (300 ml/100 L water) Kelpak applied three times and a control. The 0.2% Kelpak was applied at 50% bloom, full bloom and three more times at monthly intervals. The 0.3% Kelpak treatment was applied at full bloom and twice more at monthly intervals. All other standard management practices were followed in the trial orchard. Tree vigour was evaluated during the season, nut drop was recorded during the main drop stages and nut yield per tree and crack-out percentage were measured at harvest.

continued...

Figure 1. % INCREASE IN MARKETABLE RETURN ABOVE CONTROL, MALAWI

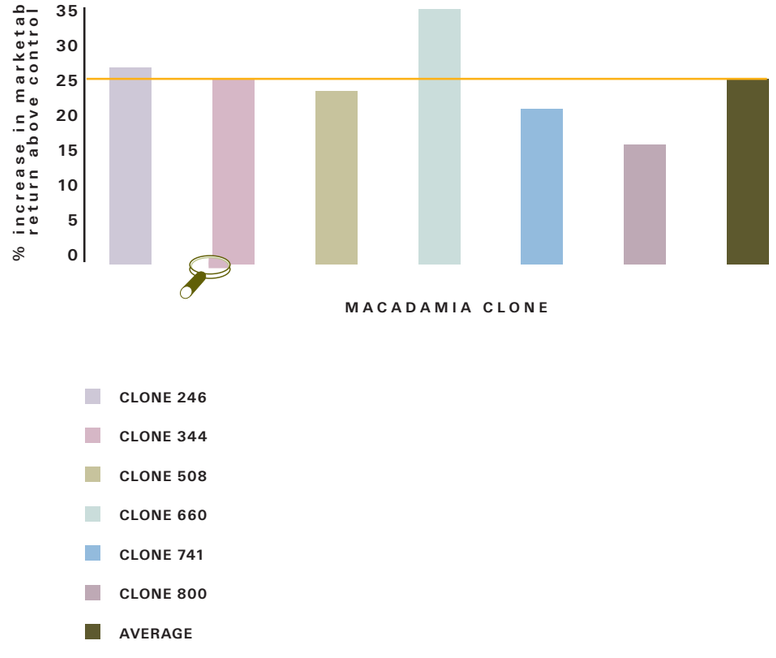

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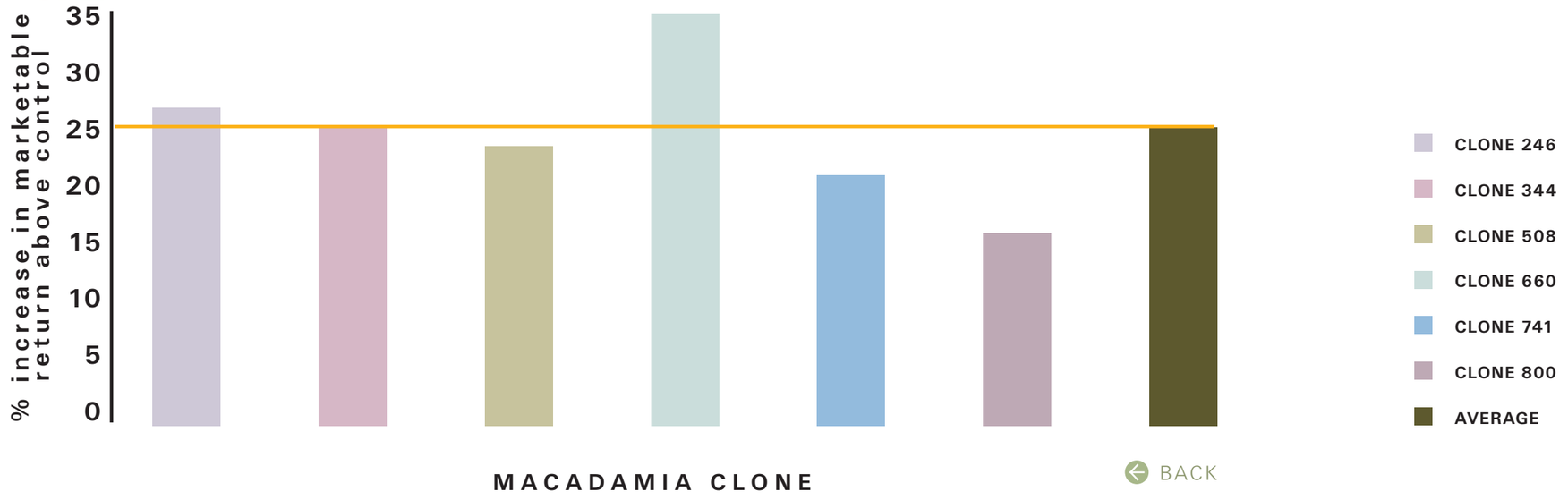
Figure1. % INCREASE IN MARKETABLE RETURN ABOVE CONTROL, MALAWI



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Both Kelpak treatments had more vigorous growth ratings than the control, with the 0.2% Kelpak the best (Table 1). Significantly less nut drop was recorded for both Kelpak treatments compared to the control, with the 0.2% Kelpak treatment the most successful at 36% less nut drop. Visual evaluations at this time illustrated the increased nut set of the Kelpak treatments compared to the control treatment (Figure 2).

Both Kelpak treatments had higher nut yields than the control, with the 0.2% Kelpak treatment statistically significant with a 15% improvement. Kelpak treatments had no effect on crack-out percentage of the nuts. Kelpak treated trees resulted in greater nut set and less nut drop with a higher nut yield without compromising nut quality and, therefore, a higher net return than the control trees. continued...

Table 1. Evaluation of Kelpak trial on Macadamia, Mpumalanga Province, South Africa

TREATMENT	GROWTH SCORE	TOTAL FRUIT DROP (kg)*	TREE YIELD (kg/tree)*	CRACKOUT %
Control	2.96	38a	18.6a	34 ns
Kelpak 0.2%x5	3.58	24b (-36%)	21.4b (+15%)	34 ns
Kelpak 0.3%x3	3.12	30ab (-21%)	20.1ab (+8%)	33 ns

***Values with the same letter do not differ significantly from each other; ns = not significant, (p=0.05)*

CONTROL | KELPAK

Figure 2.

RECOMMENDATION FOR BEARING MACADAMIA

RATE Apply 0.2% Kelpak (200 ml Kelpak/100 L water) as a full cover foliar spray

TIMING at 50% bloom and full bloom, and repeat twice or three times at monthly intervals.

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Table 1. Evaluation of Kelpak trial on Macadamia, Mpumalanga Province, South Africa

TREATMENT	GROWTH SCORE	TOTAL FRUIT DROP (kg)*	TREE YIELD (kg/tree)*	CRACKOUT %
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Almond

Several trials were conducted on almonds in California, covering four locations and the varieties Fritz, Mission and Nonpareil. Treatment always consisted of three applications of Kelpak, with the first starting at 50% bloom. Initially, with the first application a simulated fertigation application was compared to a full cover spray. All other applications were done as a full cover spray using 1000 L water/ha (100 gallons/acre). The rates tested were either 2 or 3 L/ha (2 or 3 pints/acre) and the intervals between application varied from 14 to 21 days.

All Kelpak treatments gave numerical nut meat yield increases above the control, although not all differed significantly (Table 2). On average, the application by foliar spray at 50% bloom was as effective as the fertigation application. Only two Kelpak treatments gave less than 20% increase above the control, with the lowest yield increase at 7% and the second lowest at 15%.

All the other Kelpak treatments had yield increases above 20%, with the highest increases above 40%. The average yield increase over all Kelpak treatments compared to the control was 714 kg/ha, 27% higher than the control. The yield increases were attributed to better nut set and retention as the meat to nut ratios were not affected by the Kelpak treatments. continued...

IMPERIAL | METRIC

TABLE 2

Effect of Kelpak treatment on the yield of almonds in California

VARIETY	RATE (pints/acre)	PLANTING (trees/acre)	1st APPLICATION	MEAT YIELD (pounds/acre)		INCREASE %
				Control	Kelpak	
Nonpareil	3	124	3 x spray	3236	3474	7
Nonpareil	3	124	drench + 2 x spray	3236	4721	46
Fritz	3	124	3 x spray	2666	3313	24
Fritz	3	124	drench + 2 x spray	2666	3445	29
Fritz	3	87	3 x spray	1973	2840	44
Fritz	3	87	drench + 2 x spray	1973	2270	15
Mission	3	110	3 x spray	2336	2916	25
Fritz	2	306	3 x spray	1724	2140	24
Fritz	3	306	3 x spray	1724	2148	25
Average				2393	3030	27

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IMPERIAL | METRIC

TABLE 2

Effect of Kelpak treatment on the yield of almonds in California

VARIETY	RATE (pints/acre)	PLANTING (trees/acre)	1st APPLICATION	MEAT YIELD (pounds/acre)		INCREASE %
				Control	Kelpak	
Nonpareil	3	124	3 x spray	3236	3474	7
Nonpareil	3	124	drench + 2 x spray	3236	4721	46
Fritz	3	124	3 x spray	2666	3313	24
Fritz	3	124	drench + 2 x spray	2666	3445	29
Fritz	3	87	3 x spray	1973	2840	44
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Average				2393	3030	27

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IMPERIAL | METRIC

TABLE 2

Effect of Kelpak treatment on the yield of almonds in California

VARIETY	RATE (L/ha)	PLANTING (trees/ha)	1st APPLICATION	MEAT YIELD (kg/ha)		INCREASE %
				Control	Kelpak	
Nonpareil	3	306	3 x spray	3627	3894	7
Nonpareil	3	306	drench + 2 x spray	3627	5292	46
Fritz	3	306	3 x spray	2988	3713	24
Fritz	3	306	drench + 2 x spray	2988	3861	29
Fritz	3	215	3 x spray	2211	3183	44
Fritz	3	215	drench + 2 x spray	2211	2544	15
Mission	3	272	3 x spray	2618	3268	25
Fritz	2	306	3 x spray	1932	2399	24
Fritz	3	306	3 x spray	1932	2407	25
Average				2682	3396	27

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Almonds in Australia

Newly planted Carmel and Monterey trees in Australia were treated with a soil drench and two periodical foliar applications early in the growing season. This lead to a good increase in average trunk diameter of treated versus control trees at the end of the growing season. The treated trees were also sprayed twice with Kelpak at 3 pints in 100 gallons water/acre (3 L in 1000 L water/ha) at 50% bloom and at shuck split in the first year of production. The Carmel treated trees yielded on average 8.6 lb (3.9 kg) per tree and the control trees 7.5 lb (3.4 kg) in shell nuts, an increase in yield of 13%. Similarly, the Monterey treated trees yielded 18.1 lb (8.2 kg) per tree and the control trees 15.7 lb (7.1 kg), an increase of 15%. Two trials were conducted in older Nonpareil orchards in the northern Adelaide plains. Kelpak was applied at 3 pints in 100 gallons water/acre (3 L in 1000 L water/ha) at 30 to 50% bloom, and again 14 to 21 days later. Root density assessments on feeder roots at several depths showed improved rooting for the Kelpak treatments. Similarly, the Kelpak-treated trees showed an increase in fruit set of 10 to 20% above the control trees. The Kelpak treatment yielded on average 23% more kernel weight than the control (Table 3), with 2% more nut meat on crack-out and a 14% increase in medium to large size nuts.

These consistent trial results give sufficient proof that Kelpak is a useful tool to improve nut set and meat yields in almonds. The recommended use is 2 to 3 pints/acre (2 to 3 L/ha) applied as a full cover spray in 100 gallons water/acre (1000 L/ha), applied at 30 to 50% bloom and one to two additional sprays with 14 to 21 day intervals. Kelpak can be applied with most crop protection and foliar nutrient products. continued...

KELPAK

TABLE 3

Effect of Kelpak treatment on the yield of almonds in Australia

TREATMENT	KERNEL WEIGHT (lb/acre)	KERNEL WEIGHT (kg/ha)	CRACK-OUT (%)	MEDIUM + LARGE NUTS (%)
Control 1	2130	2388	27	36
Kelpak 1	2960	3318	29	54
Improvement	+39%		+2%	+18%
Control 2	2480	2780	–	49
Kelpak 2	2710	3038	–	59
Improvement	+9%		–	+10%

RECOMMENDATION FOR BEARING ALMONDS

RATE 2 to 3 pints/acre (2 to 3 L/ha) applied as a full cover spray in 100 gallons water/acre (1000 L/ha)

TIMING Apply at 30 to 50% bloom and one to two additional sprays with 14 to 21 day intervals

TABLE 3

Effect of Kelpak treatment on the yield of almonds in Australia

TREATMENT	KERNEL WEIGHT (lb/acre)	KERNEL WEIGHT (kg/ha)	CRACK-OUT (%)	MEDIUM + LARGE NUTS (%)
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Improvement	+39%		+2%	+18%
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Kelpak 2	2710	3038	–	59
Improvement	+9%		–	+10%

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Hazelnut

Two demonstration trials were done on Barcelona hazelnuts in Oregon, USA. Kelpak was applied approximately five weeks after bud break (early June) and again one month later (early July) at 2 L/ha (2 pints/acre). In a third trial, the Kelpak was applied at 4 L/ha (2 quarts/acre) together with a foliar nitrogen product. In all the trials the Kelpak treatments produced yield increases (Table 4). Two additional hazelnut trials were conducted with Kelpak applied at 2 L/ha (2 pints/acre), starting application earlier at end May and again in mid-July. The Kelpak treatments respectively yielded 11 and 17% more than the control. The average yield increase over all these trials suggests yield improvement above 10% with two Kelpak applications on hazelnuts. The recommended use of Kelpak on hazelnuts is 2 to 3 L/ha (2 to 3 pints/acre) applied approximately four weeks after bud break and repeated four weeks thereafter.

continued...

TABLE 4

Effect of Kelpak on Barcelona hazelnuts in Oregon

TREATMENT	YIELD					
	TRIAL 1 2 L/ha; pts/ac					
	(lb/acre)	(kg/ha)	(lb/acre)	(kg/ha)	(lb/acre)	(kg/ha)
Control	2940	3295	3105	3480	2500	2802
Kelpak	3295	3693	3233	3624	3300	3699
Yield increase	355	398	128	144	800	897

TABLE 4

Effect of Kelpak on Barcelona hazelnuts in Oregon

TREATMENT	YIELD					
	TRIAL 1 2 L/ha; pts/ac		TRIAL 2 2 L/ha; pts/ac		TRIAL 3 4 L/ha; pts/ac + N	
	(lb/acre)	(kg/ha)	(lb/acre)	(kg/ha)	(lb/acre)	(kg/ha)
Control	2940	3295	3105	3480	2500	2802
Kelpak	3295	3693	3233	3624	3300	3699
Yield increase	355	398	128	144	800	897

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Pistachio

A trial on the pistachio variety Kerman on Atlantic rootstock was conducted in Merced County, California. Kelpak was applied at 50% bloom and petal fall, 40 days later at rates of 2 or 3 L/ha (2 or 3 pints/acre). Both treatments showed an increase in yield, with the 3 L/ha (3 pints/acre) significantly different from the control at an increase above 20% (Table 5). The current recommendation for Kelpak on pistachio is 3 L/ha (3 pints/acre) applied at 50% bloom and four weeks thereafter.

Excellent increases in pistachio yield with both Kelpak treatments were achieved. The higher Kelpak rate of 3 pints/acre (3 L/ha) produced the largest increase in yield and return (Table 5).

RECOMMENDATION FOR BEARING PISTACHIO NUTS

RATE 3 L/ha (3 pints/acre)

TIMING Apply at 50% bloom and four weeks thereafter

TABLE 5

Yield and return for Kelpak pistachio trial, California

TREATMENT	YIELD (ton/acre)	YIELD (kg/ha)	RETURN ($/acre)	% INCREASE
Control	2.72	6093	12 500	–
Kelpak 2 L/ha; pts/ac	3.13	7011	14 400	15
Kelpak 3 L/ha; pts/ac	3.38	7571	15 500	24

TABLE 5

Yield and return for Kelpak pistachio trial, California

TREATMENT	YIELD (ton/acre)	YIELD (kg/ha)	RETURN ($/acre)	% INCREASE
Control	2.72	6093	12 500	–
Kelpak 2 L/ha; pts/ac	3.13	7011	14 400	15
Kelpak 3 L/ha; pts/ac	3.38	7571	15 500	24

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Conclusion

An overview of all the trials indicates that Kelpak improved yield by increasing the fruit set and retention in all these nut crops. Further trials on almonds, macadamia, pistachio and pecan nuts are in the evaluation process and will be reported on in due course. Kelpak is a cost-effective way of improving the yield of various nut crops.

New nut orchards

The use of Kelpak to reduce transplant shock and assist with the establishment of a strong root system is well known, and seedling root dips or nursery bag drenches are recommended for establishment of new orchards. Apply 0.5% Kelpak (500 ml Kelpak/100 L water; 2 pints/50 gallons water) as a nursery bag drench or dip the roots of bare rooted nursery plants in a 1% Kelpak and fungicide solution prior to transplant. Kelpak can be added to this treatment at 1 L Kelpak/100 L solution to replace the soil drench directly after transplant. To ensure strong development during the growth season, the root treatment is followed with monthly foliar sprays of a 0.3 to 0.5% Kelpak solution (300 ml to 500 ml Kelpak/100 L water; 1 to 2 pints/50 gallons water).

For optimum results, Kelpak should not be diluted more than 1:500 (0.2%); the pH of the final spray mix should be lower than 7; Kelpak should preferably not be applied at intervals less than 14 days; Kelpak is compatible in a tank mix with most nutrients and pesticides; the use of a surfactant is recommended when applying Kelpak.

This concludes our update report on the use of Kelpak on nuts from the Tech Desk. Our thanks to Wayne Sledge in Oregon, and Bill Ambaras and Vic Zabo in Australia for use of trial results. Please visit our website for more information on a wide range of crops: www.kelpak.com