

## EFFECTS OF FOLIAR APPLICATIONS OF KELPAK SL AND GOËMAR BM 86<sup>®</sup> PREPARATIONS ON YIELD AND FRUIT QUALITY IN TWO STRAWBERRY CULTIVARS

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### A B S T R A C T

From 2001 to 2003, a study was carried out on the effects of foliar applications of the seaweed preparations, Kelpak SL and Goëmar BM 86<sup>®</sup>, on two strawberry cultivars: 'Elkat' and 'Salut'. Growth, yield, fruit weight, fruit firmness, and susceptibility to gray mold (*Botrytis cinerea*) were evaluated. Both Kelpak SL and Goëmar BM 86<sup>®</sup> significantly improved yield in 'Elkat'. Neither Kelpak SL nor Goëmar BM 86<sup>®</sup> affected yield in 'Salut'. Kelpak SL reduced fruit weight in 'Salut', but not in 'Elkat'. Goëmar BM 86<sup>®</sup> did not affect fruit weight in either 'Elkat' or 'Salut'. Both Kelpak SL and Goëmar BM 86<sup>®</sup> reduced fruit firmness in both 'Elkat' and 'Salut'. Neither Kelpak SL nor Goëmar BM 86<sup>®</sup> had any effect on susceptibility to gray mold in either 'Elkat' or 'Salut'.

**Key words:** strawberry, seaweeds, bioregulators, fertilizer, Kelpak SL, Goëmar BM 86<sup>®</sup>

### INTRODUCTION

More and more, strawberry producers are using environmentally friendly production methods to improve fruit quality. EEC Regulation No. 2092/91 permits the use of organic and mineral preparations, such as Kelpak SL and Goëmar BM 86<sup>®</sup>, in organic farming.

Kelpak SL is a growth stimulator derived from the seaweed *Ecklenia*

*maxima*. It contains natural cytokinins (trans-zeatin, cis-zeatin, trans-ribosyl-zeatin, dihydrozeatin, isopentenyl-adenosine and isopentenyladenine – 0.031 mg/l in total), and auxins (indole-3-acetic acid, indole-3-carboxylic acid, indole-3-aldehyde, N,N-dimethyltryptamine and N-hydroxyethylphthalimide – 11 mg/l in total).

Goëmar BM 86<sup>®</sup> is a fertilizer derived from the seaweed *Ascophyllum*

*nodosum*, and is a good source of nitrogen (4.2%). It also contains many amino acids, phytohormones, vitamins and polysaccharides, which improves blossoming and fruit development. Goëmar BM 86<sup>®</sup> is also rich in magnesium (4.8% MgO), sulfur (3.9% S), boron (2.0% B) and molybdenum (0.02% Mo).

The aim of this study was to assess the effects of foliar applications of Kelpak SL and Goëmar BM 86<sup>®</sup> on growth, yield, fruit weight, fruit firmness, and susceptibility to gray mold (*Botrytis cinerea*) in two strawberry cultivars, 'Elkat' and 'Salut'.

## MATERIAL AND METHODS

The study was carried out at the Pomological Orchard of the Institute of Pomology and Floriculture in Skierniewice, Poland.

The experiment on Kelpak SL was carried out in 2001-2002. On May 11, 2001, frigo daughter plants of the strawberry cultivars 'Elkat' and 'Salut' were planted 0.25 meters apart in separate rows one meter apart in a fixed block arrangement with five replicates of ten plants per treatment. Immediately before planting, the plants were soaked in either a 0.5% or 1.0% solution of Kelpak SL for ten minutes. After planting, the plants were sprayed either with two liters of Kelpak SL per hectare three times two weeks apart (June 1, 15 and 29, 2001), or with three liters of Kelpak SL per hectare twice 24 days apart (June 1 and 25, 2001) (Tab. 1). On April 9, 2002, at the beginning of vegetative growth, the plants were watered with 150 ml of either a 0.5% or

1.0% solution of Kelpak SL. The plants were again sprayed either with two liters of Kelpak SL per hectare three times two weeks apart (April 30, May 14 and 28, 2002), or with three liters of Kelpak SL per hectare twice 21 days apart (April 30 and May 21, 2002). The treatments are shown in the first column of Table 1.

The experiment on Goëmar BM 86<sup>®</sup> was carried out in 2002-2003. In 2002, the experiment was conducted on two-year-old plants of both 'Elkat' and 'Salut', planted on April 19, 2002. In 2003, the experiment was conducted on one-year-old plants of 'Elkat', planted at the beginning of September 2002. The plants were planted 0.25 x 1 meter apart in one row, with four random replicates of fifteen plants each. The plants were sprayed with three liters of Goëmar BM 86<sup>®</sup> three times two weeks apart.

In both the Kelpak SL and Goëmar BM 86<sup>®</sup> experiments, plants were sprayed with a 'Kwazar' hand-operated sprayer set at 400 l/ha. No measures were taken to protect plants against gray mold. Treatments against other pests and diseases were carried out in accordance with the recommendations of the plant protection program. Plants were watered with a drip-irrigation system.

Results were elaborated by analysis of variance followed by Duncan's multiple range t-test at  $P = 0.05$ .

## RESULTS AND DISCUSSION

'Elkat' and 'Salut' responded differently to Kelpak SL and Goëmar BM 86<sup>®</sup>. Both Kelpak SL and Goëmar

Foliar applications of Kelpak SL and Goëmar BM 86<sup>®</sup> in strawberry

Table 1. Effect of Kelpak SL on yield, fruit weight, fruit firmness and susceptibility to gray mold in the strawberry cultivars 'Elkat' and 'Salut' (Skierniewice, averages for 2001 and 2002)

Treatment protocol	Marketable yield [kg/plot]			Average fruit weight [g]	Fruit quality	
	2001	2002	total		firmness [N]	susceptibility to gray mold [%]
<b>'Elkat'</b>						
1. Control	0.3 a	5.8 b	6.1 a	10.5 a	1.39 c	22.8 ab
2. Soaking + watering 0.5% + 3 x 2 l/ha*	0.3 a	6.9 c	7.2 b	10.6 a	1.17 a	22.5 ab
3. Soaking + watering 1.0% + 3 x 2 l/ha*	0.3 a	4.8 a	5.1 a	10.2 a	1.30 b	18.7 a
4. Soaking + watering 0.5% + 2 x 3 l/ha *	0.4 a	7.1 c	7.5 b	11.2 a	1.35 bc	24.1 b
5. Soaking + watering 1.0% + 2 x 3 l/ha *	0.4 a	7.2 c	7.5 b	10.8 a	1.26 b	21.0 ab
<b>'Salut'</b>						
1. Control	0.9 a	6.9 a	7.8 a	10.9 b	1.62 b	12.8 a
2. Soaking + watering 0.5 % + 3 x 2 l/ha *	0.8 a	6.5 a	7.3 a	9.8 a	1.42 a	15.2 a
3. Soaking + watering 1.0 % + 3 x 2 l/ha *	0.8 a	7.0 a	7.8 a	9.9 a	1.41 a	13.8 a
4. Soaking + watering 0.5 % + 2 x 3 l/ha *	0.8 a	6.7 a	7.5 a	9.6 a	1.47 a	13.4 a
5. Soaking + watering 1.0 % + 2 x 3 l/ha *	0.8 a	7.0 a	7.8 a	10.1 ab	1.48 a	14.4 a

Results followed by the same letter do not differ significantly at P = 0.05 according to Duncan's t-test

\* Immediately before planting in 2001, the plants were soaked for 10 minutes in a 0.5% or 1.0% Kelpak SL solution. On April 9, 2002, each plant was watered with 150 ml of a 0.5% or 1.0% Kelpak SL solution

Table 2. Effect of Goëmar BM 86<sup>®</sup> on yield, fruit weight, fruit firmness, and susceptibility to gray mold in the strawberry cultivars ‘Elkat’ and ‘Salut’ (Skierniewice, 2002 and 2003)

Combination	Marketable yield [kg/plot]		Average fruit weight [g]		Fruit quality firmness [N]		susceptibility to gray mold [%]	
	2002*	2003**	2002*	2003**	2002*	2003**	2002*	2003**
<b>‘Elkat’</b>								
Control	7.0 a	0.7 a	8.6 a	10.7 a	1.18 b	1.11 b	24.4 a	0.0 a
Goëmar (3 x 3 l/ha)	8.2 b	1.0 b	9.2 a	10.9 a	1.11 a	1.00 a	23.4 a	0.0 a
<b>‘Salut’</b>								
Control	7.2 a	-	9.1 a	-	1.68 b	-	17.0 a	-
Goëmar (3 x 3 l/ha)	6.8 a	-	8.5 a	-	1.57 a	-	22.0 a	-

Results followed by the same letter do not differ significantly at P = 0.05 according to Duncan’s t-test

\* two-year-old plants; \*\* one-year-old plants

BM 86<sup>®</sup> significantly improved yield in ‘Elkat’. Neither Kelpak SL nor Goëmar BM 86<sup>®</sup> affected yield in ‘Salut’. Kelpak SL reduced fruit weight in ‘Salut’, but not in ‘Elkat’. Goëmar BM 86<sup>®</sup> did not affect fruit weight in either ‘Elkat’ or ‘Salut’. Both Kelpak SL and Goëmar BM 86<sup>®</sup> reduced fruit firmness in both ‘Elkat’ and ‘Salut’. Neither Kelpak SL nor Goëmar BM 86<sup>®</sup> had any effect on susceptibility to gray mold in either ‘Elkat’ or ‘Salut’ (Tabs 1 and 2).

Unlike ‘Salut’, ‘Elkat’ responded favorably to both Kelpak SL and Goëmar BM 86<sup>®</sup>, although, with Kelpak SL, this response was significant only in the second year of the experiment (Tab. 1). Kelpak improved two-year cumulative yield in ‘Elkat’ the most when applied according to treatments 2 (18%), 4 (23%), and 5 (23%). Temple and Bomke (1989) reported a 24% average increase in bean yield after foliar application of Kelpak SL. However,

Kelpak SL reduced fruit firmness in both ‘Elkat’ and ‘Salut’ in most treatments. Kelpak SL reduced fruit weight in ‘Salut’, but not in ‘Elkat’. Kelpak SL did not affect susceptibility to gray mold in either ‘Elkat’ or ‘Salut’.

Goëmar BM 86<sup>®</sup> increased yield by 17.7% in two-year-old ‘Elkat’ plants in 2002, and by 52.7% in one-year-old ‘Elkat’ plants in 2003. Jadczyk-Tobjasz (2004) reported that Goëmar BM 86<sup>®</sup> improves yield in the strawberry cultivar ‘Elsanta’. Goëmar BM 86<sup>®</sup> reduced fruit firmness, but had no effect on fruit weight or susceptibility to gray mold. Szwonek (2003) reported that Goëmar BM 86<sup>®</sup> increases firmness in apples.

Earlier studies have shown that individual cultivars of the same species may respond differently to treatments of seaweed extracts. For example, they may improve the yield of one cultivar of potato but not another grown under the same

conditions, as reported by McHugh and Lawrence (2003).

### CONCLUSIONS

Kelpak SL and Goëmar BM 86<sup>®</sup> improved yield in the strawberry cultivar 'Elkat'. Both Kelpak SL and Goëmar BM 86<sup>®</sup> reduced fruit quality in both 'Elkat' and 'Salut' by reducing fruit firmness.

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## WPŁYW DOLISTNEGO STOSOWANIA PREPARATÓW KELPAK SL I GOËMAR BM 86<sup>®</sup> NA PLON I JAKOŚĆ OWOCÓW DWÓCH ODMIAN TRUSKAWKI

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### S T R E S Z C Z E N I E

Badano wpływ dolistnego stosowania preparatów Kelpak SL i Goëmar BM 86<sup>®</sup>, opartych na wyciągach z alg morskich na wzrost i plonowanie odmian truskawki 'Elkat' i 'Salut'. Wykazano zróżnicowaną reakcję odmian na te preparaty. Nie stwierdzono wpływu żadnego z preparatów na wysokość plonu odmiany 'Salut', ale u odmiany 'Elkat' wystąpiło zwiększenie plonowania po zastosowaniu obu preparatów. Oba preparaty nie miały wpływu na wielkość owoców i ograniczenie ich podatności na gnienie u obu badanych odmian, a także przyczyniały się do obniżenia jędrności owoców.

**Słowa kluczowe:** truskawka, *Fragaria x ananassa*, bioregulatory, algi morskie, plonowanie, jakość owoców