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THE RESPONSE OF SWEET BASIL (*Ocimum basilicum* L.) TO THE APPLICATION OF GROWTH STIMULATORS AND FORECROPS

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Abstract

A field experiment in growing sweet basil was carried out in the period 2008-2010 in Fajsławice (Lublin region), on podzolic soil. The study evaluated the biometric traits of the plants, yield, the qualitative parameters of herbal raw material and weed infestation of the crop in dependence on growth simulators (Asahi SL, Bio-algeen, Titanit) and the forecrop (winter wheat or spring barley + white mustard cover crop). Plots without foliar application of the growth stimulators were the control treatment. Tillage, mineral NPK fertilization as well as mechanical and chemical weed control were typical for this plant species and consistent with the recommendations for herbal plant protection.

A hypothesis was made that the application of growth stimulators would have a positive effect on basil productivity, raw material quality and weed infestation of the basil crop. It was also assumed that the phytosanitary and fertilizing effects of the cover crop would result in higher and qualitatively better yield compared to the cereal forecrop alone (winter wheat).

The best quantitative parameters of sweet basil raw material and the highest reduction in air-dry weight of weeds in the crop were observed after the application of the growth stimulators. The forecrop – spring barley + a white mustard cover crop that is ploughed in – also had a beneficial effect on yield and weed infestation of the plant in question. The traditional crop protection method used in the basil crop, without the application of the growth stimulators, resulted in a lower plant height and a smaller number of shoots per plant. This caused higher weed infestation of the crop and a decrease in yield. The positive side of the non-application of growth stimulators was a better chemical composition of basil raw material. Asahi SL and Tytanit yielded the best growth and productivity of the basil plants.

Key words: sweet basil, *Ocimum basilicum* L, yield, biometric traits, essential oil, foliar fertilizers, forecrop

INTRODUCTION

Sweet basil (*Ocimum basilicum* L.) belongs to a group of plants that should be characterized by high yields of raw material and a large amount of active substances contained in the plant, with a possibly low level of fertilization and limited rates of plant protection agents. In the opinion of Berbeć et al. (2003), the application of biostimulators can play a major role in increasing yields and improving plant health. Biostimulators supply macro- and micronutrients to the plant, thereby increasing its resistance to pests. In Western Europe herb growers have been using plant growth stimulators on a large scale for over a dozen years. Biostimulators contain, for example, titanium (Titanit), sodium salts as well as ortho- and para-nitrophenolates (Ashai SL), or natural extracts from sea algae (Bioalgeen S 90). They activate metabolic processes in the plant, stimulate pollination, fertilisation, seed and fruit setting as well as increase resistance to fungal and bacterial diseases (Carvajal and Alcaraz, 1998). The above-mentioned preparations also stimulate the development of the root system of plants, in this way making them resistant to adverse environmental conditions (Pais, 1983; Carvajal and Alcaraz, 1998; Dobromilska et al. 2008).

The proper selection of a forecrop, including cover cropping, should also be included in ecological methods used to stimulate plan growth and development. As a rule, cereal forecrops are a worse stand for herbal plants than root forecrops (Kwiatkowski and Kołodziej, 2005). However, growing cover crops after a cereal crop can effectively mitigate the negative consequences of the unfavourable crop stand, resulting in higher yield of a herbal plant and lower weed infestation of the crop (Kwiatkowski, 2007). Cover crops, in particular those from the family Brassicacae (mustard, rape, oil radish), play a major phytosanitary role and improve the quality of the soil environment (physical, chemical, and biological properties) as well as they are a factor reducing soil nitrogen losses. The ploughing-in of cover crop biomass has a positive influence on the productivity of plants sown after cover crops (Lal et al. 1991; Oleszek et al. 1994; Richards et al. 1996; Akemo et al. 2000; Kwiatkowski, 2006).

The above facts allowed us to make a hypothesis that the stimulation of the growth of sweet basil plants by the application of the biostimulators would produce better and higher yields, in terms of quality and quantity, compared to the traditional method without foliar fertilization. It was also assumed that the application of a cover crop in sweet basil growing would produce the "phytosanitary" effect in the stand after the cereal plant and contribute to a reduction in weed infestation of the crop as well as to an improvement in the qualitative parameters of herbal raw material.

The aim of the study was to analyse some biometric and qualitative traits as well as yield and weed infestation of sweet basil as a result of the application of various growth stimulators and two forecrops.

MATERIALS AND METHODS

The field experiment was carried out in the period 2008-2010 in Fajsławice (Lublin region). The experiment was set up as a split-plot design, with 3 replicates, in 10 m^2 plots. Sweet basil (variety Kasia) was grown on incomplete podzolic soil (pH in 1 mol KCl = 6.3), classified as good wheat complex and characterized by high availability of essential macronutrients (P = 88.3; K = 102.8; Mg = 35.9 mg×kg^{-1}). The soil humus content was 1.51%. Seeds were sown directly into the soil using a seed drill with a press wheel (in the 1st decade of May), with a row spacing of 30 cm, at a rate of 8 g per 10 m2 (plot), i.e. 8 kg×ha^{-1} (Dachler and Pelzman 1999). Mineral fertilization, calculated on a per hectare basis, was applied at the following rates: N – 60 kg (30 kg before plantation establishment and 30 kg after emergence), P – 20 kg, K – 80 kg (before plantation establishment). Mineral N fertilization was applied in the form of 34% ammonium nitrate, P in the form of 46% granulated triple superphosphate, whereas K in the form of 50% potassium salt. Weed control in the basil plantation was carried out using a mechanical and chemical weed management method that is common in the Lublin region and consistent with the recommendations of... (2007) (spike tooth harrow before emergence + herbicide Reglone Turbo 200 SL (diquat) – 3 l×ha^{-1} as well as mechanical weed control in the interrows (a hand hoe) at the 3-5-leaf stage of sweet basil).

The experimental design included the following factors:

I. Growth stimulators:
- A – No application of biostimulators (control treatment);
- B – Foliar spraying with Asahi SL – Atonik (0.1%);
- C – Foliar spraying with Bio-algeen S 90 (1.0%);
- D – Foliar spraying with Tytanit (0.05%).

II. Forecrops:
1. Winter wheat
2. Spring barley + stubble crop (white mustard), ploughed in autumn.

Conventional tillage was used, adapted to the specificity of the herbal plant in question. The growth stimulators (treatments B-D) were applied using a field sprayer under a pressure of 0.25 MPa. The amount of spraying liquid per 1 ha was 200 litres. These biostimulators were applied twice: in the second decade of June and in the first decade of July.

Before the harvest of basil, weed infestation of the crop was evaluated (air-dry weight of weeds) in randomly selected sampling areas (1 m^2) marked out with a wooden frame. Several days before the harvest of basil, plant height and number of branches per plant were estimated based on 30 randomly selected plants from each plot.

Basil was harvested in the middle of August (beginning of the flowering stage), by cutting the herb with a sickle bar mower at a height of about 5 cm. After harvest, the herb was dried in a belt dryer at a temperature of ca. 35°C. Specific determinations of the following traits were made: dry herb yield (t ha^{-1}), essential oil content (% of air-dry weight (ADW)) according to Polish Pharmacopoeia VIII [2008], total N content (% ADW) – by the distillation method (Parnas-Wagner apparatus), the content of P, K, Ca and Mg (% ADW) – by atomic absorption spectrometry (AAS) (Nowosielski, 1988; Kabata-Pendias and Pendias, 1999).

The study results were statistically verified, determining the significance of differences using Tukey's test, with a 5% risk of error. The study results obtained did not differ significantly between experimental years; therefore, the averages for 2008-2010 are shown in the tables.

RESULTS AND DISCUSSION

The application of the growth stimulators had a significant effect on sweet basil plant height (Table 1).

Spraying the basil plantation with Asahi SL and Tytanit resulted in a ca. 12% increase in the height of the herbal plant (4.3 cm), compared to the control treatment, and a ca. 10% increase (3.4 cm) compared to the plants treated with the sea algae extract (Bio-algeen). The regeneration of the stand after the cereal crop by white mustard cover cropping, irrespective of the foliar fertilization method, resulted only in a tendency towards a higher height of the basil plants.

All the biostimulators under study had a significant effect on the increase in the number of shoots per plant relative to the control plots, on average by 16.7% (Asahi), 15.5% (Tytanit), and 9.1% (Bio-algeen). The forecrops did not differentiate significantly the trait under discussion; however, the stand after spring barley and the cover crop promoted the development of a higher (by nearly 4%) number of shoots by the basil plants (Table 2).

Significantly higher weed infestation of the basil crop, as expressed in air-dry weight of weeds per unit area, was observed in the control treatment and in the plots in which foliar application of the growth stimulator Bio-algeen was used (Table 3). Regardless of the forecrop, spraying the basil crop with Asahi and Tytanit resulted in the production of lower weed biomass by approx. 17-23%. Most probably, it was directly associated with the higher and better branched basil plants in the above-mentioned treatments, which competed more effectively with the weeds. The forecrop – spring barley + white mustard – also resulted in a significant reduction in air-dry weight of weeds. Under such conditions, weed biomass was lower on average by nearly 16% compared to the stand after winter wheat.

The growth stimulators in question had a significant effect on the increase in basil herb yield compared to the control treatment: Asahi (on average by 31%), Tytanit (28%), Bio-algeen (22%). At the same time, the preparations Asahi and Tytanit caused a significant increase in basil herb yield relative to the treatments sprayed with Bio-algeen (Table 4). In the control treatment conditions, air-dry weight of basil herb showed a significant negative correlation (r = -0.67) with the weed infestation level in the plantation (air-dry weight of weeds). The correlation coefficients determined on the basis of the study results obtained from the other treatments ranged from -0.16 to -0.21 and they were statistically insignificant.

Growing the white mustard cover crop after spring barley, regardless of foliar fertilization, contributed to higher productivity of basil by 13.4% (0.29 t ha^{-1}) compared to the stand after winter wheat (Table 4).

In the present study, the stimulators Asahi SL (Atonik) and Titanit (Ti 0.8%) had the most beneficial effect on the biometric features and yield of basil. Numerous scientific papers inform about the positive influence of growth stimulators on yield of various plants. But in the literature there is a lack of information on the direct and indirect effects of growth stimulators on weeds. Berbeć et al. (2003) obtained a 25% increase in thyme herb yield under the influence Asahi SL. In the study of Król (2009), the application of Asahi SL, in combination with a foliar fertilizer Mikromol, resulted in increased productivity of the above-ground parts of thyme by 13.6%. Kołodziej (2004) also demonstrated the positive effect of this biostimulator on American ginseng yield. In turn, Pulkrábek (1996) as well as Czeczko and Mikos-Bielak (2004) reported a stimulating effect of spraying with Asahi SL on yields of vegetables and root crops (sugar beet and potato). This results from the fact that the compounds contained in Asahi SL (sodium salts of 5-nitroguaiacolate, ortho- and para-nitrophenolates) are natural plant constituents in small amounts, and when applied exogenously, they affect the growth processes and plant productivity (Kołodziej, 2004; Król, 2009). Nevertheless, no significant increase in tomato yield under the influence of Asahi SL was found in the experiment of Vavrin (1998).

Some authors draw attention to the beneficial influence of titanium on plant biochemical processes, which in consequence leads to the acceleration of growth and increased yields of plants (Carvajal and Alcaraz, 1998; Skupień and Oszmiański, 2007). Thanks to the application of titanium, Pais (1983) obtained an increase in yield of berry plants by about 26%, whereas Prusiński and Kaszkowiak (2005) reported a 20% growth in yellow lupin yield under the influence of Tytanit.

In the study under discussion, Bio-algeen was characterized by a lower impact on the simulation of growth and yield of sweet basil compared to Atonik and Tytanit. The study of Król (2009) also demonstrated lower efficiency of Bio-algeen than that of Asahi SL in the formation of above-ground biomass of garden thyme. However, Matátko (1992) showed the beneficial effect of Bio-algeen on hop productivity.

The application of white mustard cover cropping had a slight positive effect on the biometric traits (plant height, number of shoots) compared to the treatments with the cereal forecrop (wheat). However, the cultivation of white mustard contributed to a distinct reduction in air-dry weight of weeds in the crop and, as a consequence, to higher yield of basil. Kwiatkowski (2007) achieved an almost twofold reduction in weed biomass in a thyme crop grown after spring barley and an increase in herb yield by 6% under the influence of the ploughed-in biomass of lacy phacelia grown as a cover crop. In an experiment with a spring barley monoculture, this author recorded an increase in cereal productivity by 15% and a reduction in weed biomass in the crop by 40% as a result of the ploughing -in of a white mustard cover crop (Kwiatkowski, 2009b). The results of the study of Kwiatkowski and Kołodziej (2005) relating to the response of garden thyme to a forecrop show that, likewise in the present study, the stand after winter wheat turned out to have the highest weed infestation level. This was directly translated into the lowest yield of dry thyme herb, irrespective of the crop protection method.

The significantly highest amount of essential oil was determined in the sweet basil herb harvested from the control treatment and in that collected from the plots sprayed with Bio-algeen (Table 5). Foliar fertilization with the biostimulators Asahi SL and Tytanit resulted in a lower accumulation of oil, on average by 0.27% ADW. However, the theoretical yield of essential oil, irrespective of the forecrop, was the highest in the treatment combination in which Asahi (on average 45.5 kg×ha^{-1}) and Bio-algeen (45.4 kg×ha^{-1}) as well as Tytanit (44.4 kg×ha^{-1}) were applied. On the other hand, the theoretical yield of essential oil from the herbal material obtained from the control treatment was 36.3 kg×ha^{-1}. This resulted from a simple dependence – oil yield is a product of oil percentage content in raw material and raw material yield. The forecrop did not have a major influence on the content of essential oil in basil raw material.

The significantly highest nitrogen content in basil raw material was found under the control treatment conditions and as a result of foliar application of Tytanit (Table 6). The highest decrease in nitrogen content (by 0.47-0.59% ADW) was observed after the application of Bio-algeen. Spraying with Asahi SL resulted in an average reduction in N content by 0.45-0.57% ADW. The forecrop spring barley + white mustard cover crop, regardless of the biostimulators, contributed to a significant increase in nitrogen content by 0.20% ADW compared to the stand after winter wheat.

Phosphorus content in basil raw material was significantly dependent on both experimental factors (Table 7). The highest accumulation of this macronutrient was found in the samples from the control treatment and from the plots sprayed with Tytanit. Foliar fertilization of the basil plants with Bio-algeen and Asahi resulted in a lower content of phosphorus, on average by 0.08% ADW. The phytosanitary and fertilizing effects of the white mustard cover crop were translated into higher phosphorus content in basil herb by 0.11% ADW compared to that obtained after the cereal forecrop (winter wheat).

The individual options of foliar fertilization of the plants did not modify significantly potassium content in basil raw material. However, a statistically proven higher content of this component was found in the plants grown after the spring barley and white mustard forecrop (Table 8).

The application of the growth stimulators did not also have a large influence on magnesium and calcium content in basil raw material (Tables 9 and 10). The cultivation of sweet basil in the stand after spring barley + white mustard cover crop gave the significantly highest content of Ca and Mg, likewise in the case of the other macronutrients. The cereal forecrop (winter wheat) contributed to a decrease in the content of these components by, respectively, 0.17% ADW (Mg) and 0.18% ADW (Ca).

The content of essential oil in sweet basil raw material was similar to the results given in other papers (Seidler-Łożykowska et al. 2007; Kwiatkowski, 2009a). The highest decrease in oil content was found after the application of Asahi SL and Tytanit, which is confirmed by the results of the study of Król (2009) on the example of garden thyme. Some authors draw attention to the fact that an increase in herb yield as a result of the application of Asahi SL results in worsening of the chemical composition of herbal material. However, higher plant productivity causes the yield of a desired component (e.g. sugars, vitamins, oils) to be also higher (Pulkrábek, 1996; Berbeć et al. 2003; Król, 2009). Similar observations are presented by Pais (1983), Kołodziej (2004) as well as Skupień and Oszmiański (2007) with respect to the influence of titanium on the accumulation of chemical components in ginseng, sugar beet, and alfalfa.

In most cases, the crop stand had a significant effect on the variation in the chemical composition of basil raw material. The more beneficial forecrop resulted in a tendency towards a higher accumulation of essential oil and in a distinct improvement in the content of macronutrients in the herb. This is confirmed by the results of the studies of Kwiatkowski and Kołodziej (2005) as well as of Kwiatkowski (2007) relating to the chemical composition of garden thyme. The content of nitrogen, phosphorus, potassium, magnesium, and calcium in basil raw material reported in the present study was within the ranges presented in other publications concerning this plant (Marsh et al. 1976; Seidler-Łożykowska et al. 2007).

Table 1.
The height of sweet basil plants (cm) – mean for 2008-2010

Specification	Foliar fertilization				
Forecrop	Control	Asahi SL	Bio-algeen	Tytanit	Mean
Winter wheat	31.3	35.6	31.9	36.0	33.7
Spring barley + cover crop	33.2	37.4	34.4	36.9	35.4
Mean	32.2	36.5	33.1	36.4	–

$NIR_{0,05}$ for: $LSD_{0.05}$
foliar fertilization methods = 2.92
forecrop = r.n. n.s.

Table 2.
The number of shoots (lateral branches) per sweet basil plant (in pcs.) – mean for 2008-2010

Specification	Foliar fertilization				
Forecrop	Control	Asahi SL	Bio-algeen	Tytanit	Mean
Winter wheat	23.8	28.5	25.2	28.1	26.4
JSpring barley + cover crop	24.2	29.2	27.6	28.7	27.4
Średnio – Mean	24.0	28.8	26.4	28.4	-

$NIR_{0,05}$ for: $LSD_{0.05}$
foliar fertilization methods = 2.09
forecrop = r.n. n.s.

Table 3.
Air-dry weight of weeds ($g \times m^{-2}$) in the sweet basil crop before the harvest of the herb – mean for 2008-2010

Specification	Foliar fertilization				
Forecrop	Control	Asahi SL	Bio-algeen	Tytanit	Mean
Winter wheat	44.6	33.9	40.7	34.0	38.3
Spring barley + cover crop	36.9	28.6	34.7	29.1	32.3
Mean	40.7	31.2	37.7	31.5	-

$NIR_{0,05}$ for: $LSD_{0.05}$
foliar fertilization methods = 5.09
forecrop = 4.95

Table 4.
Air-dry yield of sweet basil herb ($t \times ha^{-1}$) – mean for 2008-2010

Specification	Foliar fertilization				
Forecrop	Control	Asahi SL	Bio-algeen	Tytanit	Mean
Winter wheat	1.42	2.19	1.85	2.06	1.88
Spring barley + cover crop	1.75	2.41	2.20	2.33	2.17
Mean	1.58	2.30	2.02	2.19	-

$NIR_{0,05}$ for: $LSD_{0.05}$
foliar fertilization methods = 0.164
forecrop = 0.206

Table 5.
Essential oil content in sweet basil herb (% ADW) – mean for 2008-2010

Specification	Foliar fertilization				
Forecrop	Control	Asahi SL	Bio-algeen	Tytanit	Mean
Winter wheat	2.29	1.97	2.24	2.01	2.13
Spring barley + cover crop	2.31	2.00	2.27	2.06	2.16
Mean	2.30	1.98	2.25	2.03	-

$NIR_{0,05}$ for: $LSD_{0.05}$
foliar fertilization methods = 0.204
forecrop = r.n.-n.s.

Table 6.
Nitrogen (N) content in sweet basil herb (% ADW) – mean for 2008-2010

Specification	Foliar fertilization				
Forecrop	Control	Asahi SL	Bio-algeen	Tytanit	Mean
Winter wheat	3.15	2.69	2.71	3.31	2.96
Spring barley + cover crop	3.37	2.93	2.88	3.45	3.16
Mean	3.26	2.81	2.79	3.38	-

$NIR_{0,05}$ for: $LSD_{0.05}$
foliar fertilization methods = 0.248
forecrop = 0.195

Table 7.
Phosphorus (P) content in sweet basil herb (% ADW) – mean for 2008-2010

Specification	Foliar fertilization				
Forecrop	Control	Asahi SL	Bio-algeen	Tytanit	Mean
Winter wheat	0.49	0.43	0.40	0.53	0.46
Spring barley + cover crop	0.61	0.54	0.52	0.60	0.57
Mean	0.55	0.48	0.46	0.56	-

$NIR_{0,05}$ for: $LSD_{0.05}$
foliar fertilization methods = 0.062
forecrop = 0.098

Table 8.
Potassium (K) content in sweet basil herb (% ADW) – mean for 2008-2010

Specification	Foliar fertilization				
Forecrop	Control	Asahi SL	Bio-algeen	Tytanit	Mean
Winter wheat	4.69	4.51	4.46	4.62	4.57
Spring barley + cover crop	5.35	5.24	5.18	5.41	5.29
Mean	5.02	4.87	4.82	5.01	-

$NIR_{0,05}$ for: $LSD_{0.05}$
foliar fertilization methods = r.n.-n.s.
forecrop = 0.692

Table 9.
Magnesium (Mg) content in sweet basil herb (% ADW) – mean for 2008-2010

Specification	Foliar fertilization				
Forecrop	Control	Asahi SL	Bio-algeen	Tytanit	Mean
Winter wheat	2.18	2.09	2.11	2.16	2.13
Spring barley + cover crop	2.33	2.27	2.29	2.31	2.30
Mean	2.25	2.18	2.20	2.23	-

$NIR_{0,05}$ for: $LSD_{0.05}$
foliar fertilization methods = r.n.-n.s.
forecrop = 0.164

Table 10.
Calcium (Ca) content in sweet basil herb (% ADW) – mean for 2008-2010

Specification	Foliar fertilization				
Forecrop	Control	Asahi SL	Bio-algeen	Tytanit	Mean
Winter wheat	2.19	2.16	2.13	2.21	2.17
Spring barley + cover crop	2.37	2.30	2.33	2.41	2.35
Mean	2.28	2.23	2.23	2.31	-

$NIR_{0,05}$ for: $LSD_{0.05}$
foliar fertilization methods = r.n.-n.s.
forecrop = 0.171

CONCLUSIONS

1. The growth stimulators (Asahi SL, Bio-algreen, Tytanit) contributed to a better growth of sweet basil plants, lower weed infestation of the crop, and an increase in herb yield by 22-31%.
2. The selection of a forecrop was of lesser significance for the selected biometric traits of the basil plants, but white mustard cover cropping had a distinct effect on a reduction of weed biomass in the crop and on higher productivity of the plant under study.
3. The cultivation without foliar fertilization produced the best chemical composition of sweet basil raw material (the content of essential oil, N, P, K). Nevertheless, due to higher herb yield, the theoretical yield of essential oil was higher when the growth stimulators were applied.
4. The crop stand (spring barley + white mustard cover crop) had a positive effect on the accumulation of the macronutrients under study (N, P, K, Mg, Ca) in the basil herb.
5. Among the growth stimulators applied, Asahi SL and Tytanit were found to have the best yield-increasing effect.

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Reakcja bazylii pospolitej (*Ocimum basilicum* L.) na stosowanie stymulatorów wzrostu i przedplony

Streszczenie

Doświadczenie polowe z uprawą bazylii pospolitej przeprowadzono w latach 2008-2010 w Fajsławicach (woj. lubelskie), na glebie bielicowej. Oceniano cechy biometryczne rośliny, plonowanie, parametry jakościowe surowca zielarskiego oraz zachwaszczenie łanu w zależności od stymulatorów wzrostu (Asahi SL, Bio-algeen, Titanit) i przedplonu (pszenica ozima oraz jęczmień jary + międzyplon z gorczycy białej). Obiektem kontrolnym były poletka bez dolistnego stosowania stymulatorów wzrostu. Uprawa roli, nawożenie mineralne NPK oraz mechaniczno-chemiczna pielęgnacja były typowe dla gatunku rośliny i zgodne z zaleceniami dotyczącymi ochrony roślin zielarskich.

Przyjęto hipotezę, że zastosowanie stymulatorów wzrostu wpłynie pozytywnie na produkcyjność bazylii, jakość surowca i zachwaszczenie tej rośliny. Założono również, że fitosanitarne i nawozowe oddziaływanie międzyplonu pozwoli na uzyskanie większych i korzystniejszych jakościowo plonów w porównaniu z samym przedplonem zbożowym (pszenica ozima).

Najkorzystniejsze parametry ilościowe surowca bazylii pospolitej, jak również największą redukcję powietrznie suchej masy chwastów w łanie obserwowano po aplikacji stymulatorów wzrostu. Korzystne oddziaływanie na plonowanie i zachwaszczenie analizowanej rośliny posiadał także przedplon – jęczmień jary + gorczyca biała jako międzyplon na przyoranie. Tradycyjna metoda pielęgnacji zasiewów bazylii, bez aplikacji stymulatorów wzrostu, wpływała na mniejszą wysokość roślin i mniejszą liczbę pędów z rośliny. Skutkowało to większym zachwaszczeniem łanu oraz spadkiem poziomu plonowania. Pozytywną stroną braku aplikacji stymulatorów wzrostu był korzystniejszy skład chemiczny surowca bazylii. Preparaty Asahi SL oraz Tytanit przyczyniały się do najlepszego wzrostu i produkcyjności roślin bazylii.