ÞEMËS ÛKIO MOKSLAI. 2004. Nr. 1. P. 36–40


*Sodininkystë ir darþininkystë*
*Horticulture*
*Садоводство и овощеводство*

# Growth and yielding of the large cranberry *Vaccinium macrocarpon* Ait. fertilized with nitrogen and potassium 2. The quality of berries

**Aneta Úwieczkowska, Zdzisùaw Kawecki**

*University of Warmia and Mazury, 10-957 Olsztyn, ul. Prawocheñskiego 21*

**Vidmantas Stanys**

*Lithuanian Institute of Horticulture Babtai, LT-4335 Lithuania E-mail: institutas@lsdi.lt*

The results of a research on specific qualitative features of berries of the large cranberry cultivars 'Ben Lear', 'Pilgrim', 'Searles' and 'Stevens' grown on the artificially prepared peat solum obtained from highmoor peatbog in the conditions of north-eastern part of Poland (Olsztyn) are presented. The following features were examined: the mass of 100 berries, dry matter content, the content of saccharides, the content of organic acids and pectins.

The highest mass of berries was found in *cv.* 'Stevens' and the lowest in *cv.* 'Searles'. Application of nitrogen and potassium (10 kg/ha) increased the mass of berries. The content of dry matter varied depending on cultivars and nutrition. The highest content of dry matter and sugars was found in berries of *cv.* 'Searles'. Higher doses of fertilizers reduced the content of dry matter. The highest content of acids was found in berries of *cv.* 'Ben Lear' and the lowest in berries of *cv.* 'Searles'. Higher doses of N and K increased the content of acids in berries. Berries of *cv.* 'Pilgrim' contained the highest levels of pectins. Higher doses of nitrogen and potassium fertilizers had a positive effect on pectin accumulation.

**Key words**: large cranberry, nutrition, cultivars, mass of berries, dry matter, total sugars, acids, pectins

## INTRODUCTION

Cranberries are regarded as a perfect raw material for various products, especially juice. An increasing demand for berries has been observed, particularly after reports of a team of American physicians stating that cranberry juice enhances urinary tract clearance and can be used to treat bladder infections [2, 7]. In 1989, a polymer that adheres to the thin cilia of bacteria and produces antiadhesive effects to the mucous connective tissue of the intestines and urinary bladder was isolated. It causes the excretion of bacteria with urine [1, 6, 13, 15]. Bomser [3] reports that cranberry juice has also an anticarcinogenic effect.

The objective of the current research was to evaluate the quality of cranberries grown on artificially prepared solum with the use of differentiated nitrogen and potassium nutrition.

## MATERIALS AND METHODS

The detailed methodology related to the research was described in Part 1 of the paper. In Part 2, the

methods used for determination of qualitative features of berries are presented.

The mass of 100 berries was determined using a general laboratory balance. The berries were randomly sampled from the whole portion of each replicate of a particular experimental variant. Three tests of each replicate were performed.

The content of dry matter was determined by the method of drying. The samples were dried at 105 °C. The content of organic acids was determined by the Peterburski method. The results were multiplied by the coefficient of apple acid content. Total sugars were examined by the Luff-Schoorl method and pectins by the Moris method.

The figures obtained were statistically analysed with the use of the analysis of variance. The mean values were evaluated by the T-Tukey test at a significance level p = 0.05.

## RESULTS AND DISCUSSION

The mass of the berries varied significantly depending on cultivars and levels of nitrogen and potassium nutrition (Table 1). The mass of 100 berries in each cultivar was differentiated in particular years of the experiment. The value of this feature was by far the highest in *cv.* 'Stevens' (160.4 g) and the lowest in *cv.* 'Searles' (121.7 g). Another factor that significantly affected this value was nitrogen and potassium nutrition. The application of N and K fertilizers at 10 kg of each element resulted in the highest mass of 100 berries (144.1 g). Higher doses of nitrogen and potassium had no positive effect on the increase in the mass of berries. It was even lower than in control, but the difference was not significant. As the statistical analysis shows, the heaviest berries (154.5 g on average) were obtained in 1999. Significantly lighter berries were obtained in 1998 and 2000.

The content of dry matter varied by cultivar, nutrition and year (Table 2). Berries of all the cultivars contained the highest levels of dry matter in 1998 and 2000. The content of dry matter amounted to 11% per berry on average. The lowest content of dry matter was obtained by application of the highest doses of fertilizers, *i.e.* 20 kg per hecta-

Table 1. **Effect of nitrogen and potassium nutrition on the mass of 100 berries of large cranberry in 1998–2000 (g)**

| Cultivar | Years | Control | $N_{10}K_{10}$ | $N_{20}K_{20}$ | Mean |
|---|---|---|---|---|---|
| | | Years × cultivars × nutrition | | | Years × cultivars |
| 'Ben Lear' | 1998 | 130.4c | 133.9c | 118.1d | 127.5d |
| | 1999 | 140.2c | 148.2b | 148.1b | 145.5c |
| | 2000 | 118.3d | 139.2c | 114.2d | 123.9d |
| 'Pilgrim' | 1998 | 126.3c | 134.4c | 119.9d | 126.9d |
| | 1999 | 162.4b | 168.9a | 176.2a | 169.2b |
| | 2000 | 141.7c | 157.2b | 129.5c | 142.8d |
| 'Searles' | 1998 | 112.9d | 131.4c | 122.4c | 122.2d |
| | 1999 | 123.7c | 118d | 122.2c | 121.3d |
| | 2000 | 130.8c | 115.3d | 118.2d | 121.4d |
| 'Stevens' | 1998 | 150.2b | 143.8b | 152.5b | 148.8c |
| | 1999 | 184.3a | 186.2a | 175.2a | 181.9a |
| | 2000 | 147.7b | 153b | 150.7b | 150.5c |
| $LSD_{0.05}$ | | | 20.03 | | 11.79 |
| | | Cultivars × nutrition | | | Cultivars |
| 'Ben Lear' | | 129.6c | 140.4b | 126.8c | 132.3c |
| 'Pilgrim' | | 143.5b | 153.5a | 141.9b | 146.3b |
| 'Searles' | | 122.5c | 121.6c | 120.9c | 121.7d |
| 'Stevens' | | 160.7a | 161.0a | 159.5a | 160.4a |
| $LSD_{0.05}$ | | | 9.63 | | 5.27 |
| | | Years × nutrition | | | Years |
| | 1998 | 130.0c | 135.9b | 128.2c | 131.4b |
| | 1999 | 152.7a | 155.3a | 155.4a | 154.5a |
| | 2000 | 134.6b | 141.2b | 128.2c | 134.7b |
| $LSD_{0.05}$ | | | 7.91 | | 5.29 |
| | | Nutrition | | | |
| | | 139.1b | 144.1a | 137.3b | |
| $LSD_{0.05}$ | | | 3.44 | | |

Table 2. **Effect of nitrogen and potassium nutrition on the content of dry matter in berries of large cranberry in 1998–2000 (%)**

| Cultivar | Years | Control | $N_{10}K_{10}$ | $N_{20}K_{20}$ | Mean |
|---|---|---|---|---|---|
| | | Years × cultivars × nutrition | | | Years × cultivars |
| 'Ben Lear' | 1998 | 11.29c | 11.01c | 10.99c | 11.10b |
| | 1999 | 10.50d | 10.44d | 10.64d | 10.53c |
| | 2000 | 11.17c | 10.19e | 10.39d | 10.58c |
| 'Pilgrim' | 1998 | 10.58d | 10.60d | 10.32e | 10.50c |
| | 1999 | 10.63d | 10.78d | 9.78e | 10.40c |
| | 2000 | 10.65d | 10.21e | 10.18e | 10.35c |
| 'Searles' | 1998 | 11.27c | 11.10c | 11.08c | 11.15b |
| | 1999 | 11.34c | 10.96c | 11.20c | 11.17b |
| | 2000 | 11.99b | 12.09a | 11.40c | 11.83a |
| 'Stevens' | 1998 | 11.60b | 11.32c | 11.71bv | 11.54ab |
| | 1999 | 10.23e | 10.79d | 10.02e | 10.35c |
| | 2000 | 12.53a | 12.35a | 11.04c | 11.97a |
| $LSD_{0.05}$ | | 0.462 | | 0.281 | |
| | | Cultivars × nutrition | | | Cultivars |
| 'Ben Lear' | | 10.99b | 10.55cv | 10.67c | 10.74b |
| 'Pilgrim' | | 10.62c | 10.53c | 10.09d | 10.41c |
| 'Searles' | | 11.53a | 11.38a | 11.23b | 11.38a |
| 'Stevens' | | 11.45a | 11.49a | 10.92c | 11.29a |
| $LSD_{0.05}$ | | | 0.222 | | |
| | | Years × nutrition | | | Years |
| | 1998 | 11.19b | 10.01b | 11.03b | 11.07a |
| | 1999 | 10.68c | 10.74c | 10.41d | 10.61b |
| | 2000 | 11.59a | 11.21b | 10.75c | 11.18a |
| $LSD_{0.05}$ | | | 0.182 | | 0.115 |
| | | Nutrition | | | |
| | | 11.15a | 10.99b | 10.73c | |
| $LSD_{0.05}$ | | | 0.079 | | |

re each. The highest content of dry matter was obtained from the plots with no fertilizers applied.

Taking into account the factors applied during 3 years of the research, the highest content of dry matter was found in berries of *cv.* 'Stevens' in 2000 when 10 kg N and K per hectare was applied, and in control. Similar results were observed in *cv.* 'Searles' in the same year.

A research on six cranberry cultivars conducted by Elle [4] showed a positive correlation between the genotype of cultivars and some features of vegetative growth such as the number of flowers and berries per shoot and a negative correlation between the genotype and the number of seeds or the mass of berries.

The mass of berries varied significantly in different cultivars. The highest value of this feature was found in *cv.* 'Stevens'. Prange and DeEll report that the quality of yield is affected by the following factors: genotype, climate, mineral nutrition, water supply, cultivation techniques, diseases and pests and growth regulators.

It was revealed by the authors of the present paper that, apart from genotype, the mass of berries was most significantly affected by N and K nutrition at 10 kg. A limited demand of the large cranberry for nutrition was observed.

The content of dry matter determined in the berries of the cultivars was similar to that obtained by Fellers and Esselen [5]. In an experiment on nutrition of the blackcurrants conducted by Kawecki and Olszewski [8], an increase in dry matter was observed only after application of light doses of fertilizers, especially nitrogen.

The total content of sugars depended on the cultivar and on nitrogen and potassium nutrition (Table 3). The highest value of the feature was noted in *cv.* 'Searles' and the lowest in *cv.* 'Pilgrim' (4.65% and 3.96%, respectively). Among the nutrition variants applied, the most significant effect was achieved with 10 kg N and 10 kg K per hectare. The highest content of sugars (4.42% on average) was found at the same dose. The content of total sugars in berries was highly differentiated in particular years. The mean value in 2000 was significantly higher than in previous years and amounted to 4.43%.

The content of organic acids also varied in dependence on the cultivar and on the doses of fertilizers (Table 4). The highest content of acids (2.96%) was found in berries of *cv.* 'Ben Lear' and the lowest in *cv.* 'Searles' (2.60%). The heaviest doses of nitrogen and potassium (20 kg per hectare) increased the content of acids in berries as compared to the control and to the lighter doses. In 2000, berries accumulated less acids than in the previous years.

Table 3. **Effect of nitrogen and potassium nutrition on the content of total sugars in berries of large cranberry in1998–2000 (%)**

| Cultivar | Years | Control | $N_{10}K_{10}$ | $N_{20}K_{20}$ | Mean |
|---|---|---|---|---|---|
| | | | Years × cultivars × nutrition | | Years × cultivars |
| 'Ben Lear' | 1998 | 4.04c | 4.16b | 4.05c | 4.08c |
| | 1999 | 3.69c | 4.11c | 4.33b | 4.04c |
| | 2000 | 4.14b | 4.35b | 3.75c | 4.08c |
| 'Pilgrim' | 1998 | 4.04c | 4.27b | 3.84c | 4.05c |
| | 1999 | 3.84c | 3.86c | 3.27d | 3.66d |
| | 2000 | 4.04c | 4.35b | 4.16b | 4.18c |
| 'Searles' | 1998 | 4.32b | 4.78a | 4.72a | 4.61a |
| | 1999 | 4.31b | 4.8a | 4.19b | 4.43b |
| | 2000 | 4.51b | 4.97a | 5.23a | 4.90a |
| 'Stevens' | 1998 | 4.5b | 4.41b | 4.28b | 4.40b |
| | 1999 | 4.7a | 4.46b | 4.03c | 4.40b |
| | 2000 | 4.42b | 4.54b | 4.65b | 4.54b |
| $LSD_{0.05}$ | | | 0.516 | | 0.256 |
| | | | Cultivars × nutrition | | Cultivars |
| 'Ben Lear' | | 3.96b | 4.21b | 4.04b | 4.07c |
| 'Pilgrim' | | 3.97b | 4.16b | 3.76c | 3.96c |
| 'Searles' | | 4.38b | 4.85a | 4.71a | 4.65a |
| 'Stevens' | | 4.54b | 4.47b | 4.32b | 4.44b |
| $LSD_{0.05}$ | | | 0.248 | | 0.114 |
| | | | Years × nutrition | | Years |
| | 1998 | 4.23b | 4.41a | 4.22b | 4.28b |
| | 1999 | 4.14b | 4.31b | 3.96c | 4.13c |
| | 2000 | 4.28b | 4.55a | 4.45a | 4.43a |
| $LSD_{0.05}$ | | | 0.204 | | 0.130 |
| | | | Nutrition | | |
| | | 4.21b | 4.42a | 4.21b | |
| $LSD_{0.05}$ | | | 0.089 | | |

The content of pectins in berries depended significantly on the cultivar and levels of nitrogen and potassium nutrition (Table 5). Berries of *cv.* Pilgrim contained considerably more pectins (0.36%) compared with other cultivars in which the content of pectins amounted to 0.31–0.32%. N and K nutrition at 20 kg per hectare had a favourable effect on the content of pectins. Its mean level amounted to 0.35%. The content of pectins in cultivars grown on the plots with no nitrogen and potassium nutrition was significantly lower. The mean value varied from 0.25 to 0.34%.

During the experiment, we found that the cultivar and nitrogen and potassium nutrition affected the content of dry matter, total sugars, acids and pectins in cranberries. Neither of the values related to the qualitative features and chemical composition of berries presented in the literature so far are discussed in relation to mineral nutrition. As Kulka and Rejowski report [10], mineral nutrition, especially full, causes an increase not only in the yield of most fruit plants, but also in the content of su-

Table 4. **Effect of nitrogen and potassium nutrition on the content of acids converted into apple acid in berries of large cranberry in 1998–2000 (%)**

| Cultivar | Years | Control | $N_{10}K_{10}$ | $N_{20}K_{20}$ | Mean |
|---|---|---|---|---|---|
| | | Years × cultivars × nutrition | | | Years × cultivars |
| 'Ben Lear' | 1998 | 3.32b | 3.18b | 3.61a | 3.37a |
| | 1999 | 2.86c | 3.08c | 2.94c | 2.96b |
| | 2000 | 2.36e | 2.67d | 2.63d | 2.55c |
| 'Pilgrim' | 1998 | 2.91c | 3.21c | 2.7d | 2.94b |
| | 1999 | 2.90c | 2.88c | 2.86c | 2.88b |
| | 2000 | 2.59d | 2.61d | 2.67d | 2.62c |
| 'Searles' | 1998 | 2.19f | 2.01f | 3.34b | 2.51c |
| | 1999 | 2.67d | 2.86c | 2.99c | 2.84b |
| | 2000 | 2.83d | 2.22f | 2.32f | 2.46d |
| 'Stevens' | 1998 | 3.21b | 2.76d | 2.71d | 2.89b |
| | 1999 | 2.84cd | 2.77d | 2.8d | 2.80c |
| | 2000 | 2.28f | 2.25f | 2.59de | 2.37d |
| $LSD_{0.05}$ | | | 0.224 | | 0.101 |
| | | Cultivars × nutrition | | | Cultivars |
| 'Ben Lear' | | 2.85b | 2.98a | 3.06a | 2.96a |
| 'Pilgrim' | | 2.8b | 2.90b | 2.74c | 2.81b |
| 'Searles' | | 2.56d | 2.36e | 2.88b | 2.60d |
| 'Stevens' | | 2.78b | 2.59d | 2.70c | 2.69c |
| $LSD_{0.05}$ | | | 0.108 | | 0.045 |
| | | Years × nutrition | | | Years |
| | 1998 | 2.91b | 2.79c | 3.09a | 2.93a |
| | 1999 | 2.82b | 2.90b | 2.90b | 2.87a |
| | 2000 | 2.52d | 2.44e | 2.55d | 2.50b |
| $LSD_{0.05}$ | | | 0.088 | | 0.067 |
| | | Nutrition | | | |
| | | 2.75b | 2.71b | 2.85a | |
| $LSD_{0.05}$ | | | 0.038 | | |

Table 5. **Effect of nitrogen and potassium nutrition on the content of pectins in berries of large cranberry in 1998–2000 (%)**

| Cultivar | Years | Control | $N_{10}K_{10}$ | $N_{20}K_{20}$ | Mean |
|---|---|---|---|---|---|
| | | Years × cultivars × nutrition | | | Years × cultivars |
| 'Ben Lear' | 1998 | 0.24b | 0.45a | 0.28b | 0.32a |
| | 1999 | 0.26b | 0.41a | 0.23b | 0.30a |
| | 2000 | 0.25b | 0.36a | 0.31b | 0.31a |
| 'Pilgrim' | 1998 | 0.34a | 0.33b | 0.43a | 0.37a |
| | 1999 | 0.32b | 0.32b | 0.36a | 0.33a |
| | 2000 | 0.37a | 0.37a | 0.41a | 0.38a |
| 'Searles' | 1998 | 0.24b | 0.33b | 0.35a | 0.31a |
| | 1999 | 0.29b | 0.31b | 0.33b | 0.31a |
| | 2000 | 0.31b | 0.36a | 0.32b | 0.33a |
| 'Stevens' | 1998 | 0.27b | 0.25b | 0.44a | 0.32a |
| | 1999 | 0.30b | 0.25b | 0.41a | 0.32a |
| | 2000 | 0.26b | 0.28b | 0.36a | 0.30a |
| $LSD_{0.05}$ | | | 0.106 | | ns |
| | | Cultivars × nutrition | | | Cultivars |
| 'Ben Lear' | | 0.25c | 0.41a | 0.27c | 0.31b |
| 'Pilgrim' | | 0.34b | 0.34b | 0.40a | 0.36a |
| 'Searles' | | 0.28b | 0.33b | 0.33b | 0.32b |
| 'Stevens' | | 0.28b | 0.26c | 0.31b | 0.31b |
| $LSD_{0.05}$ | | | 0.051 | | 0.027 |
| | | Years × nutrition | | | Years |
| | 1998 | 0.27b | 0.34a | 0.38a | 0.33a |
| | 1999 | 0.29b | 0.32b | 0.33a | 0.32a |
| | 2000 | 0.30b | 0.34a | 0.35a | 0.33a |
| $LSD_{0.05}$ | | | 0.042 | | ns |
| | | Nutrition | | | |
| | | 0.29c | 0.34b | 0.35a | |
| $LSD_{0.05}$ | | | 0.018 | | |

Means followed by the same letter do not differ significantly at $p$ – 0,05.

gars and a slight decline in acid concentration. The quality of berries is mainly affected by nitrogen and potassium nutrition. Potassium increases the content of sugars. According to Kùossowski [9], nitrogen plays an important role in the process of fruit growth and affects the size of fruit. Low or medium content of potassium in soil has a positive impact on the accumulation of acids in berries and on the acidity of juice.

The content of total sugars in the cultivars studied varied from 3.96 to 4.65%. Nowiñski [12] reports cranberries to contain 3–5% of sugars. According to £ojek [11], glucose and fructose prevail in the composition of saccharides. The concentration of saccharides in berries of the cultivars studied depended on the cultivar and nitrogen and potassium nutrition. Lower doses of fertilizers have favourable effects on the accumulation of saccharides as confirmed by Kùossowski [9]. He states that moderate doses of potassium affect the accumulation of saccharides in berries of various plant species.

## CONCLUSIONS

1. The mass of 100 berries in the cultivars varied. The highest value of this feature was found in *cv.* 'Stevens' and the lowest – in *cv.* 'Searles'. Light doses of N and K fertilizers increased the mass of 100 berries.

2. The content of dry matter depended on the cultivar and nutrition. The highest content of dry matter was observed in berries of *cv.* 'Searles'. Higher doses of nitrogen and potassium decreased the content of dry matter in berries.

3. The highest concentration of saccharides was found in berries of *cv.* 'Searles' and the lowest in *cv.* 'Pilgrim'. Lighter doses of nitrogen and potassium fertilizers increased the accumulation of sugars.

4. The highest content of acids was observed in berries of *cv.* 'Ben Lear' and the lowest in *cv.* 'Sear-

les'. Higher doses of N and K fertilizers increased the content of acids in berries of all the cultivars.

5. The content of pectins varied depending on the cultivar and nitrogen and potassium doses. Berries of *cv*. 'Pilgrim' contained the highest levels of pectins. Higher doses of mineral fertilizers (20 kg N and 20 kg K per hectare) were most favourable for accumulation of pectins in berries of the cultivars studied.

Received
26 April 2003

**References**

1. Avorn J. Reduction of bacteriuria and pyuria after ingestion of cranberry juice // Journal of the American Medicinal Association. 1994. Vol. 271. N 10. P. 751–754.
2. Bodel P. T. et al. Cranberry juice and the antibacterial action of hippuric acid // Journal of Laboratory and Clinical Medicine. 1959. Vol. 54. P. 881.
3. Bomser J. *In vitro* anticancer activity of fruit extracts from *Vaccinium* species // Planta Medica. 1996. Vol. 62. N 3. P. 212–216.
4. Elle E. Reproductive trade-offs in genetically distinct clones of Vaccinium macrocarpon, the American cranberry // Oecologia. 1996. Vol. 107. N 1. P. 61–70.
5. Fellers C. R., Esselen W. B. Cranberries and cranberry products // University of Massachusetts, Agricultural Experiment Station Bulletin. 1955. 481.
6. Howell A. B. et al. Inhibition of the Adherence of P-fimbriated *Escherichia coli* to uroepithelial-cell surfaces by proanthocyanidin extracts from cranberries // New England Journal of Medicine. 1998. Vol. 339. P. 1085–1086.
7. Kahn D. H. et al. Effects of cranberry juice on urine // Journal of the American dietetic association. 1967. Vol. 51. P. 251.
8. Kawecki Z., Olszewski H. Wpùyw zróýnicowanego nawoýenia azotowego na wzrost i plonowanie porzeczki czarnej // Rocz. Nauk Roln. S. A. Ù. 1978. Vol. 103. N 3. P. 93–104.
9. Kùossowski W. Nawoýenie roúlin sadowniczych. Warszawa: PWRiL, 1972.
10. Kulka K., Rejowski A. Biochemia. Wyd. ART, Olsztyn. 1993–1994.
11. Ùojko R. E. Konserwujem frukty i owoszczi. Miñsk: Ùazaruk, 1995.
12. Nowiñski M. Dzieje roúlin i upraw ogrodniczych. Warszawa: PWRiL, 1977.
13. Ofek I. et al. Anti-*Escherichia coli* adhesion activity of cranberry and blueberry juices // New England Journal of Medicine. 1991. Vol. 324. N 22. P. 1599.
14. Prange R. K., DeEll J. R. Preharvest factors affecting postharvest quality of berry crops // Proceedings of the colloquim: Effect of preharvest factors on postharvest quality. Montreal, Canada, 1 August 1995. HortScience. 1997. Vol. 32. N 5. P. 824–830.
15. Zafriri D. i in. Inhibitory activity of cranberry juice on adherence of type 1 and P fimbricated *Escherichia coli* to eucaryotic cells // Antimicrobial Agents Chemotherapy. 1989. Vol. 33. P. 92–98.

**Aneta Úwieczkowska, Zdzisùaw Kawecki, Vidmantas Stanys**

**STAMBIAUOGËS SPANGUOLËS (*VACCINIUM MACROCARPON* AIT.) AUGIMAS IR DERËJIMAS, TRÆÐIANT AZOTO IR KALIO TRÀÐOMIS**
**2. VAISIØ KOKYBË**

S a n t r a u k a

Darbe pateikti stambiavaisiø spanguoliø 'Ben Lear', 'Pilgrim', 'Searles' ir 'Stevens', auginamø Ðiaurës Rytø Lenkijos sàlygomis, aukðtapelkiø durpiø pagrindu parengtoje dirbtinëje dirvoje, vaisiø kokybës tyrimo duomenys. Ávertinta 100 vaisiø masë, nustatytas sausøjø medþiagø, cukrø, organiniø rûgðèiø ir pektinø kiekis.

Azoto ir kalio (10 kg/ha) tràðos didino vaisiø masæ. Parodyta, kad didþiausiais vaisiais pasiþymëjo veislë 'Stevens', o smulkiausiais – 'Searles'. Sausøjø medþiagø kiekis vaisiuose priklausë nuo veislës savybiø ir træðimo. Daugiausiai sausøjø medþiagø ir cukrø nustatyta veislës 'Searles' vaisiuose. Gausiau træðiant maþëjo sausøjø medþiagø kiekis. Didþiausias organiniø rûgðiø kiekis nustatytas veislës 'Ben Lear', maþiausias – veislës 'Searles' vaisiuose. Gausiau træðiant azoto ir kalio tràðomis didëjo organiniø rûgðèiø kiekis. Daugiausia pektinø nustatyta veislës 'Pilgrim' vaisiuose. Didesnës kalio ir azoto tràðø dozës skatino pektinø sintezæ.

**Raktaþodþiai**: cukrai, organinës rûgðtys, pektinai, stambiavaisë spanguolë, træðimas, derlingumas

**Анета Свечковска, Здислав Кавецки, Видмантас Станис**

**РОСТ И УРОЖАЙНОСТЬ КЛЮКВЫ КРУПНОПЛОДНОЙ (*VACCINIUM MACROCARPON* AIT.), УДОБРЯЕМОЙ АЗОТОМ И КАЛИЕМ**
**2. КАЧЕСТВО ПЛОДОВ**

Р е з ю м е

В работе представлены результаты исследований некоторых качественных признаков плодов клюквы крупноплодной сортов 'Ben Lear', 'Pilgrim', 'Searles' и 'Stevens', выращиваемых на почве, искусственно приготовленной из торфа верхового торфяника, в условиях Северо-Восточной Польши (г. Ольштын). Определяли массу 100 плодов, содержание сухого вещества, сахаридов, органических кислот и пектинов.

Констатировали, что наибольшей массой плодов отличался сорт 'Stevens', а наименьшей – сорт 'Searles'. Азот и калий (10 кг/га) увеличивали массу плодов. Содержание сухого вещества зависело от сорта и удобрения. Больше всего сухого вещества и сахаридов содержали плоды сорта 'Searles'. При увеличении доз удобрения уменьшалось содержание сухого вещества. Наибольшее содержание органических кислот установлено в плодах сорта 'Ben Lear', а наименьшее – в плодах сорта 'Searles'. С увеличением дозы азота и калия увеличивалось содержание органических кислот. Наибольшее содержание пектинов установлено в плодах сорта 'Pilgrim'. Большие дозы азото-калийного удобрения оказывали положительное влияние на накопление пектинов.

**Ключевые слова**: клюква крупноплодная, удобрение, сорта, фенофазы, морфология растений, урожайность