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The effects of Some Organic Compounds on Yield and Fruit Quality in Albion Strawberry (*Fragaria x ananassa* Duch) Cultivar

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HIGHLIGHTS

- Vinasse increases the yield of the strawberry.
- Molasse increases the fruit quality of the strawberry.
- Vinasse and molasse are advised to use together for strawberry growers.

Abstract

Strawberry is one of the most popular fruits in Türkiye, and its cultivation is increasing due to its high adaptability to different climatic and soil conditions. Greenhouses and conventional agriculture are preferred in strawberry cultivation in terms of both growing conditions and the applicability of good agriculture and organic agriculture. Good agriculture and organic agriculture have increased their importance in achieving reliable and quality food, according to the World Health Organization (WHO). For these reasons, the application compounds are increasing day by day. Accordingly, the types and varieties of organic compounds have increased. Albion strawberry cultivars were grown under calcareous soil conditions, and the effects of various organic component levels on yield and fruit quality were examined. In the experiment, vinasse, molasses, and vermicompost (liquid) were each employed at quantities of 2.5%, 5%, 7%, and 10%. Because of the treatments, a vinasse concentration of 2.5 % was shown to be more beneficial than the others on yield metrics such as yield per decare (1664.89 kg) and yield per plant (332.98 g) (332.98 g). There was a marked improvement in fruit quality between the molasses treatments and the other organic compound treatments. It was discovered that the treatment with molasses at a concentration of 2.5 % (15.94 %) had a greater TSS than the other treatments, whereas the treatment with molasses at a concentration of 5.0 % had to have a higher TAC of 1.058 %. Based on the results, strawberry farmers can be told that using vinas and molasses together is an effective way to increase strawberry yield and improve the quality of the fruit.

Keywords: Alkaline soil, fruit quality, organic compound, strawberry, yield

1. Introduction

In terms of complexity, fertility is the soil quality most analogous to the control of plant nutrients. The part of soil productivity that is concerned with the availability of nutrients and the soil's capacity to supply nutrients from its reserves. Nutrient dynamics and availability are influenced by of several soil variables (biological, chemical, and physical) that are combined here. To optimize crop nutrition in the short and long term and achieve sustainable crop output, it is crucial to control soil fertility, which is a soil property. About a

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quarter of the world's farmable soils are severely deficient in chemical health. Because of their widespread nature and the high expense of remediating the soils, these problems cannot be solved quickly (Vose 1983).

In addition, calcareous soils account for 30 percent of the world's land area. Due to their poor solubility at high pH and the development of relatively insoluble complexes like calcium (Ca)-phosphorus (P), these soils typically have low availability of plant nutrients including iron (Fe), manganese (Mn), copper (Cu), and zinc (Zn) (Marschner 1995). Chlorosis caused by a disruption in Fe metabolism on high Ca-containing soil is sometimes referred to as "lime-induced iron chlorosis" (Faust 1989). This ubiquitous and potentially severe nutritional issue affects several important horticulture crops (Webster et al. 2005). Horticultural crops such as peaches, pears, grapes, and strawberries are particularly susceptible to lime-induced chlorosis. Therefore, in calcareous soils, Fe chlorosis and P deficiency caused by the lime application can be particularly problematic.

Therefore, as much as 90% of the applied P is retained in an insoluble form, making it unavailable for plant uptake. Chlorosis is brought on by an excessive amount of lime, leading the farmer to spend more money on inputs by applying more fertilizer than necessary. Alternatives to chemical fertilizers and agrochemicals are desperately needed all over the world.

In sugar plants located in agricultural areas, studies on the viability of utilizing by-products other than sugar have been carried out throughout the course of the past few years. Molasses and vinas are two examples of these by-products that can be produced.

Molasses, a by-product of the sugar industry, is rich in organic matter and macro- and micro-components and are produced as a by-product of the processing of sugar beets into sugar. Ulusu and Yavuzaslanoğlu (2017) found that applying molasses to plants promoted their vegetative growth. Molasses provides the necessary nutrients for plant growth, and it plays a significant role in the rapid development of plants and the formation of fruits.

The production of sugar from sugar beets results in vinas as a byproduct. The by-product vinas are then treated in yeast factories to remove excess potassium and make it useful. Vinas is a complex organic material made up of several trace elements, macromolecules, and microorganisms. This is why it finds application in the production of fertilizer and animal feed. Vinas is used to creating both the gel and liquid organic fertilizers in the fertilizer industry (Türker et al. 2015).

In addition, it has been observed that the application of vermicompost in the process of agricultural production has been growing in popularity over the past several years. Applying vermicompost to your plants is simple, and it will improve your soil and provide essential nutrients to your plants at the same time. Many people believe that vermicompost has significant potential to improve organic farming in the future because of its involvement in plant nourishment.

This investigation's objective was to determine whether or not the addition of molasses, vinas, or vermicompost to the growing medium altered the production values or the fruit quality features of the "Albion" strawberry variety.

2. Materials and Methods

In the year 2022, this study was conducted at Selcuk University's Research and Application Orchard, which is located within the Department of Horticulture.

The "Albion" strawberry cultivar was studied in the field for a full year from the time it was a frigo seedling (*Fragaria* x *ananassa* Duch.). In 1999, the Albion variety was selected from a breeding program (Diamante x Cal 94.16-1.) at the University of California. The Albion is a day-neutral cultivar. According to research (Shaw and Larson 2006), its typical fruit is elongated, conical, and highly symmetrical.

The alkaline soil that was used in the experiment had a high lime content (29.6 %), as well as a pH level (7.80). The experiment soil preparation with river sand: alkaline soil (3:1) was used to cultivate strawberry plants in 5-liter plastic pots.

In the experiment, vinasse, molasses, and vermicompost (liquid) were each employed at quantities of 2.5%, 5%, 7%, and 10% to see what effect they had on strawberry yield and fruit quality.

The control group plants were watered to simulate a no-treatment situation. Following planting, irrigation water was used to apply all organic compounds employed in the study once each in the months of June, July, August, and September.

To evaluate the effect that organic compound treatments had on fruit production, we assessed the yield per strawberry plant (in grams), the yield per decare (in kilograms), the number of fruits produced by each plant, and the average weight of each fruit. To get a more complete picture of the quality of the fruit, further measurements such as its color (L, C, and H), total acidity content (TAC), total soluble solids (TSS), and fruit juice pH were carried out (Arıkan et al. 2020; Ipek et al. 2014).

Five plants were used in each replicate across all three treatments in a fully random order (13 treatments, 5 replicates, and 5 plants for a total of 325 plants). One-way analysis of variance (ANOVA) was used to examine all of the data, and Duncan's multiple range test was used to compare the means of groups when there was a statistically significant difference at the P = 0.05 level in SPSS 23.0. (SAS Inc., Cary, NC, USA).

3. Results and Discussion

In 2022, the yield value and fruit quality criteria were observed. At a concentration of 2.5 %, treatment of the vinasse was found to have the highest possible production value per plant (332.98 g) and the highest possible yield per decare (1664.89 kg). The highest fruit counts were found in the treatment of the molasses (7.5 %) and, the treatment of the vinasse (2.5 %) with the former producing 22.50 fruits per plant and the latter 21.92 fruits per plant. It was discovered that the treatments with a vinasse concentration of 2.5 percent (15.20 g) and 5.0 percent (15.15 g) had a fruit weight that was greater than that of the other treatments (Table 1). Compost, humic acid, amino acid, vermicompost, and salicylic acid were found in early investigations of strawberry yield to improve yield per square meter, yield per plant, average fruit weight, fruit length, and fruit diameter (Aghaeifard et al. 2016; Arancon et al. 2003; Mohamed et al. 2011; Sayğı 2022). According to the findings of Anil K Singh et al. (2015) and Rajbir Singh et al. (2008), the utilization of vermicompost resulted in an increase in the overall production of strawberries, as well as an increase in the yield per decare, yield per plant, and a number of fruits produced per plant. Researchers found that by applying molasses at varying concentrations to the soil and plant leaves three times throughout the vegetative season, sugar beet root yield may be improved by 20% (Şanlı et al. 2015). Elderberries were studied, and it was shown that applying vermicompost at a rate of 1.5 kg da^{-1} over the course of three separate periods improved both the number of shoots by 5% and the stem diameter by 2.5% (Şakar 2019).

Total soluble solids (TSS) levels varied depending on the treatment. Between 13.86% and 15.94 %, the TSS fluctuated. The TSS value found for the 2.5 % molasses treatment (15.94 %). was the highest among the tested other treatments (Table 2). There was a wide variation in acidity levels, from 0.562% to 1.0588%. The greatest amount of TAC was found in the sample that had been treated with molasses at a concentration of 5.0 % (1.058 %) (Table 2). It was discovered that strawberries had higher levels of TSS and TAC when compost, humic acid, and amino acids were present (Mohamed et al. 2011). The use of vermicompost contributed to an increase in both the TSS and TAC content of strawberries (Sayğı 2022; Anil K Singh et al. 2015; Rajbir Singh et al. 2008).

Table 1. Effect of organic compounds on yield parameters

Treatments	Yield (Plant g^{-1})	Yield (Decare kg^{-1})	Number of Fruit per Plant	Average Fruit Weight (g)
Control	198.45 m	992.24 m	15.24 g	13.04 def
Molasses 2.5%	230.05 j	1150.26 j	17.31 de	13.30 cde
Molasses 5.0%	238.35 g	1191.77 g	17.45 de	13.67 c
Molasses 7.5%	305.42 b	1527.09 b	22.50 a	13.59 cd
Molasses 10.0%	281.01 c	1405.04 c	19.74 b	14.24 b
Vermicompost 2.5%	206.14 l	1030.70 l	16.28 f	12.67 fg
Vermicompost 5.0%	251.61 e	1258.06 e	18.39 c	13.71 c
Vermicompost 7.5%	246.05 f	1230.23 f	19.31 b	12.75 efg
Vermicompost 10.0%	224.84 k	1124.17 k	17.18 e	13.11 cdef
Vinasse 2.5%	332.98 a	1664.89 a	21.92 a	15.20 a
Vinasse 5.0%	273.64 d	1368.20 d	18.07 cd	15.15 a
Vinasse 7.5%	233.96 i	1169.83 i	19.20 b	12.19 g
Vinasse 10.0%	236.96 h	1184.81 h	17.53 de	13.52 cd

Table 2. Effect of organic compounds on fruit quality parameters

Treatments	TSS (%)	TAC (%)
Control	13.69 k	0.676 gh
Molasses 2.5%	15,94 a	0,726 ef
Molasses 5.0%	14,92 d	1,058 a
Molasses 7.5%	15,17 c	0,906 b
Molasses 10.0%	15,64 b	0,844 c
Vermicompost 2.5%	14,53 g	0,562 k
Vermicompost 5.0%	14,71 ef	0,692 fgh
Vermicompost 7.5%	14,77 e	0,746 e
Vermicompost 10.0%	14,66 f	0,598 jk
Vinasse 2.5%	13,86 j	0,626 ij
Vinasse 5.0%	14,13 i	0,712 efg
Vinasse 7.5%	14,30 h	0,792 d
Vinasse 10.0%	14,04 i	0,658 hi

The L, C, and H color values of the fruit harvested in treatments of the Albion cultivar were shown in Table 3. The L, C, and H levels of the fruits from each treatment were significantly different from one another. Only the treatment with molasses at a concentration of 2.5% was capable of producing the highest L, C, and H values. The values of L, C, and H that were determined to be the greatest were 40.27, 49.68, and 40.83, respectively (Table 3). Rajbir Singh et al. (2008) and Sayğı (2022) found that when vermicompost was used, the strawberry's L, C, and H levels all went up, which led to an overall increase.

Table 3. Effect of organic compounds on fruit color

Treatments	L	C	H
Control	27.62 k	35.06 m	26.68 m
Molasses 2.5%	40.27 a	49.68 a	40.83 a
Molasses 5.0%	36.37 d	44.53 d	35.21 d
Molasses 7.5%	37.44 c	45.39 c	36.57 c
Molasses 10.0%	38.64 b	46.88 b	37.73 b
Vermicompost 2.5%	30.72 j	37.28 l	28.40 l
Vermicompost 5.0%	33.00 h	40.43 i	31.11 i
Vermicompost 7.5%	32.35 i	39.63 j	30.34 j
Vermicompost 10.0%	31.55 j	38.70 k	29.58 k
Vinasse 2.5%	33.50 h	43.71 e	34.37 e
Vinasse 5.0%	35.41 e	41.14 h	31.85 h
Vinasse 7.5%	34.79 f	42.21 g	32.60 g
Vinasse 10.0%	34.08 g	42.99 f	33.52 f

4. Conclusions

The purpose of this study was to examine the impact of various organic preparations on the growth, yield values, and fruit quality features of strawberry plants. All the treatments with the organic compounds resulted in an improvement in yield as well as the quality criterion for fruit, in comparison to the control groups. Vinasse's application at a concentration of 2.5 % yielded superior results in terms of value, but a dose of molasses applied at a concentration of 2.5 % yielded the best results in terms of quality criterion for fruit. Molasses and vinasse are both beneficial additions that might be advised to strawberry farmers as part of their cultivation practices.

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