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# Increased Production and Marketability of Day-neutral Strawberries Grown in Tunnel Structures

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**Abstract**
Day-neutral strawberries are a high-value fruit crop for commercial growers in Iowa. Dayneutral strawberries bear fruit in the fall, providing high value, off-season fruit. Tunnel production hastens the growing season and promotes greater yield and increased berry quality by protecting fruit from wind and rain. The primary goal of this project was to evaluate differences in total yield and plant biomass of day-neutral strawberries grown inside a tunnel structure and in the field with no cover. A secondary goal was to evaluate fresh and postharvest berry quality of day-neutral strawberries grown inside a tunnel structure and in the field with no cover.

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# Increased Production and Marketability of Day-neutral Strawberries Grown in Tunnel Structures

**RFR-A1044**

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## Introduction

Day-neutral strawberries are a high-value fruit crop for commercial growers in Iowa. Day-neutral strawberries bear fruit in the fall, providing high value, off-season fruit. Tunnel production hastens the growing season and promotes greater yield and increased berry quality by protecting fruit from wind and rain. The primary goal of this project was to evaluate differences in total yield and plant biomass of day-neutral strawberries grown inside a tunnel structure and in the field with no cover. A secondary goal was to evaluate fresh and postharvest berry quality of day-neutral strawberries grown inside a tunnel structure and in the field with no cover.

## Materials and Methods

In June 2010, plants of day-neutral strawberry cultivars, Albion, Seascape, and Tribute were planted in three replicated tunnel structures and field plots at the Horticulture Research Station, Ames, IA. Strawberry tunnel plots were maintained in three 15 ft × 36 ft tunnels, set up in 2010 (Farmtek, Dyersville, IA). Strawberry plants were spaced 10 in. within the row and between rows in a triple row on polyethylene mulch treatments (Pliant Corporation, GA). Rows were spaced six ft apart. Three replications of each cultivar were established for the four treatments of flower removal and polyethylene mulches:
1) polyethylene silver (metalized) mulch on white with flowers removed for six weeks after planting; 2) polyethylene silver (metalized) mulch on white over a layer of black polyethylene (two mulch layers) with flowers removed for six weeks after planting and the silver mulch was removed after the soil temperatures were less than 60°F in the fall; 3) polyethylene silver (metalized) mulch on white with flowers removed for 10 weeks after planting; 4) polyethylene silver mulch on white over a layer of black polyethylene (two mulch layers) with flowers removed for 10 weeks after planting and the silver (metalized) mulch was removed after the soil temperatures were less than 60°F in the fall. Runners were removed throughout the season. Water was provided at 1 in. per week by rainfall or through rural water irrigation. Data variables collected included total berry yield, average berry size, soluble solids concentration (SSC), initial pH, titratable acids (TA) expressed as percentage anhydrous citric acid, percentage total water mass, and percentage water loss after storage for one week. Plant biomass weight was collected after harvest was completed.

## Results and Discussion

Total berry yield of Albion, Seascape, and Tribute was generally two times higher when grown in a tunnel structure compared with field production among all flower and mulch treatments (Table 1). Yield per plot was similar within the field or tunnel plots for flower removal and mulch treatments. Albion and Seascape were both observed to have large fruit and high yields, leading to more marketable berries (berry weight data not presented).

Soluble solids concentration was more than one percent greater in Albion berries from field plots than fruit in tunnel structures

(Table 2). TA was higher in Albion fruit when grown outside than in a tunnel structure when strawberries were established in silver mulch only. Total water was 2 percent greater when berries were grown in a tunnel with silver mulch only compared to the outside plots. There were no differences among treatments for initial pH or water loss during postharvest in Albion.

There were no differences among treatments for SSC, initial pH, TA, or water loss during postharvest for Seascape. Total water was 1.5 percent greater when berries were grown in a tunnel compared with outside plots when grown in silver mulch over black mulch.

Soluble solids concentration was more than one percentage unit greater in strawberries from field plots with no cover than plots in tunnel structures in Tribute. TA was lower in strawberries grown in a tunnel structure and on silver mulch than when grown in a tunnel on either mulch treatment. There were no differences among treatments for initial pH, total water, or water lost during postharvest for Tribute.

Initial peak harvest was approximately 10 days later for Albion and approximately 15 days later for Seascape in both tunnel structures and outside plots when flowers were removed for 10 weeks after planting compared with plots with flowers removed for six weeks after planting. Initial peak for the cultivar Tribute was similar among flower removal treatments. Flower removal to change the peak harvest times did not influence total yields. Harvest duration in tunnel structures was sustained for at least a month while production in outside plots tended to drop after initial peak harvest. Techniques of flower removal to change the peak time of harvest may not be necessary when plants are grown in a tunnel structure.

This project will be continued at the Horticulture Research Station in 2011. This is the first report on growing day-neutral strawberries in tunnel structures in Iowa. Plant growth and development benefits were observed in this trial by growing day-neutral strawberries in tunnel structures compared with field plots with no cover, especially with the production of off-season fruit, which increases profits for growers and provides healthy produce for Iowa consumers.

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**Table 1. Total yield per plot of day-neutral strawberries grown in a tunnel structure and in the field with no cover with treatments of flower removal and polyethylene mulches.**

| Soil mulch treatment | | Yield per plot (g) Albion | Seascape | Tribute |
|---|---|---|---|---|
| 1) Silver mulch, flower removal six weeks after planting. | Outside | 1.4 b[zy] | 2.0 bc | 1.9 bcd |
| | Tunnel | 2.9 a | 3.2 ab | 3.2 a |
| 2) Silver mulch over black plastic, flower removal six weeks after planting. | Outside | 1.6 b | 1.3 c | 1.6 cd |
| | Tunnel | 3.2 a | 3.8 a | 2.5 ab |
| 3) Silver mulch, flower removal ten weeks after planting. | Outside | 1.6 b | 1.7 bc | 1.3 d |
| | Tunnel | 2.8 a | 3.2 ab | 2.3 bc |
| 4) Silver mulch over black plastic, flower removal ten weeks after planting. | Outside | 1.4 b | 1.9 bc | 1.2 d |
| | Tunnel | 2.9 a | 2.5 abc | 2.7 ab |
| LSD P ≤ 0.05[x] | | 1.0 | 1.5 | 0.8 |

[z]Total plot size was 21 total plants or approximately 14.5 square feet.
[y]Means are average three treatment replications.
[x]Least significant difference at P ≤ 0.05.

**Table 2. Berry quality (soluble solids concentration, initial pH, and percentage titratable acids) of day-neutral strawberry grown in a tunnel structure and in the field with no cover with treatments of flower removal and polyethylene mulches.**

| Cultivar | Soil mulch treatment | | Soluble solids concentration (%) | Initial pH | Titratable acid (%) |
|---|---|---|---|---|---|
| Albion | Silver mulch | Outside | 11.4 a[z] | 3.51 | 1.10 a |
| | | Tunnel | 9.9 b | 3.46 | 0.99 b |
| | Silver mulch over black plastic | Outside | 11.1 a | 3.50 | 1.04 ab |
| | | Tunnel | 9.6 b | 3.46 | 1.00 ab |
| LSD P ≤ 0.05[y] | | | 0.69 | NS | 0.10 |
| Seascape | Silver mulch | Outside | 10.0 | 3.44 | 0.93 |
| | | Tunnel | 9.3 | 3.42 | 0.95 |
| | Silver mulch over black plastic | Outside | 10.0 | 3.44 | 0.95 |
| | | Tunnel | 9.4 | 3.43 | 0.89 |
| LSD P ≤ 0.05[y] | | | NS | NS | NS |
| Tribute | Silver mulch | Outside | 10.7 ab | 3.33 | 1.37 a |
| | | Tunnel | 9.3 c | 3.34 | 1.19 b |
| | Silver mulch over black plastic | Outside | 10.8 a | 3.35 | 1.34 a |
| | | Tunnel | 9.8 bc | 3.33 | 1.31 ab |
| LSD P ≤ 0.05 [y] | | | 0.9 | NS | 0.14 |

[z]Average of three replications of five random berries from each plot from two different harvest dates.
[y]Least significant difference at P ≤ 0.05; NS = values sharing the same letter are not significantly different.