In general the appearance of the beets during the season was as follows: Six irrigation plots did not at any time appear to be short of moisture for optimum growth; four irrigation plots appeared to be slightly dry just previous to the irrigations and became quite dry at the last of the growing season, but no serious lack of moisture was apparent during most of the growth period; two irrigation plots were very dry with some burning of the foliage prior to the first irrigation and a serious lack of moisture was evident during the season except for a period of two or three weeks following each of the irrigations. The four inside rows of each plot were harvested; a total of 164 feet of row per plot being taken. Plot and general summaries follow.

SPACING-IRRIGATION TEST, FORT COLLINS, COLORADO, 1939
PLOT SUMMARIES

| Treatment | Plot No. | Beets Harv. | T.Beets Per A. | % Sucr. | App.Coef of Pur. | Lbs.Sug.Per A. Gross | Ind.Av. |
|---|---|---|---|---|---|---|---|
| 2 Irrigation | 131 | 210 | 14.77 | 17.80 | 93.40 | 5256 | 4909 |
| 8" Space | 139 | 178 | 10.50 | 18.00 | 94.10 | 3781 | 3558 |
| | 150 | 221 | 13.12 | 17.55 | 91.60 | 4606 | 4219 |
| | 164 | 208 | 11.52 | 17.70 | 89.85 | 4079 | 3665 |
| | 172 | 223 | 11.25 | 18.95 | 91.90 | 4264 | 3919 |
| | 183 | 178 | 6.18 | 17.90 | 86.70 | 2211 | 1917 |
| | 188 | 206 | 8.77 | 16.70 | 93.85 | 2930 | 2750 |
| | 196 | 221 | 10.50 | 16.60 | 93.15 | 3487 | 3248 |
| | 207 | 214 | 13.78 | 18.30 | 94.30 | 5042 | 4755 |
| Mean | | 207 | 11.15 | 17.72 | 92.09 | 3962 | 3660 |
| 2 Irrigation | 130 | 131 | 12.52 | 17.70 | 93.65 | 4431 | 4150 |
| 14" Space | 141 | 131 | 11.50 | 17.80 | 92.85 | 4093 | 3800 |
| | 149 | 132 | 12.45 | 18.15 | 91.65 | 4518 | 4141 |
| | 163 | 126 | 11.94 | 18.30 | 92.45 | 4369 | 4039 |
| | 174 | 114 | 5.67 | 16.20 | 86.30 | 1838 | 1586 |
| | 182 | 131 | 10.51 | 17.55 | 90.00 | 3689 | 3320 |
| | 187 | 123 | 9.86 | 16.75 | 93.20 | 3302 | 3077 |
| | 198 | 126 | 11.39 | 17.60 | 92.50 | 4011 | 3710 |
| | 206 | 130 | 14.14 | 17.70 | 93.15 | 5004 | 4661 |
| Mean | | 127 | 11.11 | 17.53 | 91.75 | 3917 | 3609 |
| 2 Irrigation | 132 | 81 | 11.00 | 16.70 | 91.45 | 3673 | 3359 |
| 20" Space | 140 | 86 | 9.94 | 17.25 | 92.20 | 3431 | 3163 |
| | 148 | 94 | 12.10 | 17.80 | 92.95 | 4306 | 4002 |
| | 165 | 87 | 6.37 | 16.35 | 89.05 | 2082 | 1854 |
| | 173 | 96 | 9.13 | 16.90 | 87.90 | 3086 | 2713 |
| | 181 | 90 | 12.30 | 16.60 | 89.15 | 4085 | 3642 |
| | 189 | 99 | 10.67 | 16.80 | 92.05 | 3585 | 3300 |
| | 197 | 76 | 11.01 | 17.10 | 91.00 | 3766 | 3427 |
| | 205 | 95 | 14.78 | 17.40 | 92.05 | 5144 | 4735 |
| Mean | | 89 | 10.81 | 16.99 | 90.87 | 3684 | 3355 |

| Treatment | Plot No. | Beets Harv. | T. Beets Per A. | % Sucr. | App. Coef of Pur. | Lbs. Suc. Per A. Gross | Lbs. Suc. Per A. Ind. Av. |
|---|---|---|---|---|---|---|---|
| 4 Irrigation 8" Space | 133 | 192 | 17.35 | 17.55 | 92.15 | 6092 | 5614 |
| | 144 | 210 | 15.47 | 16.25 | 92.00 | 5029 | 4627 |
| | 152 | 217 | 18.53 | 17.30 | 93.45 | 6413 | 5993 |
| | 157 | 202 | 13.96 | 17.00 | 93.15 | 4747 | 4422 |
| | 168 | 216 | 14.64 | 16.30 | 93.65 | 4772 | 4469 |
| | 176 | 213 | 14.91 | 16.75 | 94.00 | 4994 | 4694 |
| | 190 | 219 | 18.88 | 17.80 | 92.00 | 6720 | 6182 |
| | 201 | 176 | 13.71 | 17.85 | 92.30 | 4893 | 4516 |
| | 209 | 198 | 18.98 | 17.75 | 93.60 | 6738 | 6307 |
| Mean | | 205 | 16.27 | 17.17 | 92.92 | 5600 | 5203 |
| 4 Irrigation 14" Space | 135 | 109 | 14.03 | 16.35 | 93.05 | 4589 | 4270 |
| | 143 | 133 | 18.12 | 17.40 | 92.10 | 6306 | 5808 |
| | 151 | 121 | 18.43 | 16.10 | 92.80 | 6672 | 6192 |
| | 159 | 128 | 15.99 | 17.50 | 93.45 | 5597 | 5230 |
| | 167 | 124 | 13.49 | 17.05 | 91.10 | 4600 | 4191 |
| | 175 | 133 | 13.54 | 16.80 | 93.50 | 4549 | 4253 |
| | 192 | 133 | 12.36 | 15.75 | 91.90 | 3893 | 3578 |
| | 200 | 126 | 18.33 | 17.15 | 93.40 | 6286 | 5871 |
| | 208 | 127 | 18.05 | 17.15 | 93.15 | 6191 | 5767 |
| Mean | | 126 | 15.82 | 17.03 | 92.72 | 5409 | 5018 |
| 4 Irrigation 20" Space | 134 | 84 | 15.75 | 17.60 | 94.00 | 5545 | 5212 |
| | 142 | 93 | 17.79 | 17.75 | 94.20 | 6317 | 5951 |
| | 153 | 87 | 17.47 | 17.20 | 91.80 | 6008 | 5515 |
| | 158 | 90 | 14.30 | 17.20 | 91.80 | 4920 | 4517 |
| | 166 | 91 | 12.77 | 16.85 | 93.00 | 4305 | 4004 |
| | 177 | 86 | 14.99 | 17.45 | 93.30 | 5231 | 4881 |
| | 191 | 88 | 17.78 | 16.75 | 90.15 | 5955 | 5368 |
| | 199 | 87 | 16.88 | 16.80 | 90.50 | 5671 | 5132 |
| | 210 | 100 | 17.23 | 17.85 | 91.85 | 6150 | 5649 |
| Mean | | 90 | 16.11 | 17.27 | 92.29 | 5567 | 5137 |

| Treatment | Plot No. | Beets Harv. | T.Beets Per A. | % Sugr. | App.Coef of Pur. | Lbs.Sug.Per A. Gross | Ind.Av. |
|---|---|---|---|---|---|---|---|
| 6 Irrigation | 138 | 182 | 16.42 | 17.65 | 92.80 | 5797 | 5380 |
| 8" Space | 146 | 203 | 18.53 | 17.60 | 92.80 | 6524 | 6054 |
| | 154 | 210 | 21.99 | 17.00 | 91.05 | 7477 | 6808 |
| | 162 | 227 | 18.64 | 17.45 | 92.55 | 6505 | 6020 |
| | 170 | 226 | 19.79 | 17.15 | 92.90 | 6786 | 6304 |
| | 178 | 221 | 19.01 | 17.50 | 93.65 | 6654 | 6231 |
| | 186 | 217 | 20.82 | 17.30 | 91.90 | 7204 | 6620 |
| | 194 | 212 | 19.76 | 17.55 | 93.55 | 6936 | 6489 |
| | 202 | 201 | 14.51 | 16.90 | 90.55 | 4904 | 4441 |
| Mean | | 211 | 18.83 | 17.34 | 92.42 | 6532 | 6039 |
| 6 Irrigation | 137 | 121 | 14.30 | 17.30 | 93.00 | 4949 | 4603 |
| 14" Space | 145 | 122 | 17.89 | 17.15 | 91.50 | 6136 | 5614 |
| | 156 | 122 | 22.39 | 14.85 | 87.85 | 6650 | 5842 |
| | 161 | 132 | 16.71 | 16.45 | 93.10 | 5497 | 5118 |
| | 169 | 125 | 16.10 | 16.75 | 93.70 | 5392 | 5052 |
| | 180 | 132 | 19.98 | 17.85 | 92.90 | 7134 | 6627 |
| | 185 | 139 | 19.30 | 17.40 | 93.45 | 6716 | 6276 |
| | 193 | 130 | 18.69 | 16.95 | 92.35 | 6334 | 5849 |
| | 204 | 130 | 18.50 | 16.65 | 95.00 | 6161 | 5853 |
| Mean | | 128 | 18.21 | 16.82 | 92.54 | 6108 | 5648 |
| 6 Irrigation | 136 | 86 | 13.12 | 16.45 | 91.95 | 4318 | 3970 |
| 20" Space | 147 | 90 | 18.57 | 16.95 | 90.75 | 6297 | 5715 |
| | 155 | 82 | 21.21 | 17.00 | 90.70 | 7212 | 6541 |
| | 160 | 88 | 16.37 | 16.45 | 93.40 | 5387 | 5031 |
| | 171 | 98 | 19.36 | 17.30 | 91.05 | 6697 | 6098 |
| | 179 | 95 | 19.05 | 17.60 | 94.15 | 6706 | 6314 |
| | 184 | 93 | 17.93 | 17.20 | 91.55 | 6167 | 5646 |
| | 195 | 91 | 18.46 | 17.20 | 92.05 | 6351 | 5846 |
| | 203 | 95 | 15.20 | 16.60 | 93.15 | 5045 | 4699 |
| Mean | | 91 | 17.70 | 16.97 | 92.08 | 6020 | 5540 |

SPACING-IRRIGATION TEST, FORT COLLINS, COLORADO, 1939
GENERAL SUMMARIES

| Treatment | T.Beets Per A. | % Sugar. | App.Coef of Pur. | Lbs.Sug.Per A. Gross | Lbs.Sug.Per A. Ind.Av. | Gross Sug. Rank |
|---|---|---|---|---|---|---|
| 2 Irrigations | 11.02 | 17.41 | 91.57 | 3854 | 3541 | 3 |
| 4 Irrigations | 16.06 | 17.16 | 92.64 | 5525 | 5119 | 2 |
| 6 Irrigations | 18.24 | 17.04 | 92.35 | 6220 | 5742 | 1 |
| Mean | 15.11 | 17.20 | 92.19 | 5200 | 4801 | |
| F | 45.04* | 1.42 | 1.04 | 2782* | 25.41* | |
| S.E. of Mean | .5517 | .158 | .543 | 230.5 | 225.0 | |
| S.E. of Mean in % of Mean | 3.65% | .92% | .59% | 4.43% | 4.69% | |
| 4.303 times S.E. of a Dif. | 3.36T | .96% | 3.30% | 1403 lb | 1369 lb. | |
| **SPACINGS** | | | | | | |
| 8 inch | 15.42 | 17.41 | 92.48 | 5364 | 4967 | 1 |
| 14 inch | 15.04 | 17.12 | 92.33 | 5145 | 4758 | 2 |
| 20 inch | 14.87 | 17.08 | 91.75 | 5090 | 4677 | 3 |
| Mean | 15.11 | 17.20 | 92.19 | 5200 | 4801 | |
| F | 4.29* | 5.78** | 7.42** | 6.47** | 7.49** | |
| S.E. of Mean | .135 | .076 | .142 | 57.05 | 54.62 | |
| S.E. of Mean in % of Mean | .89% | .44% | .15% | 1.10% | 1.14% | |
| Twice S.E. of a Diff. | .38T | .21% | .40% | 161 lb | 154 lb. | |
| **SPACINGS AND IRRIGATIONS** | | | | | | |
| 2 Irrig. 8" Space | 11.15 | 17.72 | 92.09 | 3962 | 3660 | 7 |
| 2 Irrig. 14" Space | 11.11 | 17.53 | 91.75 | 3917 | 3609 | 8 |
| 2 Irrig. 20" Space | 10.81 | 16.99 | 90.87 | 3684 | 3355 | 9 |
| 4 Irrig. 8" Space | 16.27 | 17.17 | 92.92 | 5600 | 5203 | 4 |
| 4 Irrig. 14" Space | 15.82 | 17.03 | 92.72 | 5409 | 5018 | 6 |
| 4 Irrig. 20" Space | 16.11 | 17.27 | 92.29 | 5567 | 5137 | 5 |
| 6 Irrig. 8" Space | 18.83 | 17.34 | 92.42 | 6532 | 6039 | 1 |
| 6 Irrig. 14" Space | 18.21 | 16.82 | 92.54 | 6108 | 5648 | 2 |
| 6 Irrig. 20" Space | 17.70 | 16.97 | 92.08 | 6020 | 5540 | 3 |
| F | 1.61 | 3.91** | # | 2.27 | 2.08 | |

Discussion:

While the differences in yield of roots attributable to the irrigation treatments are of considerable magnitude the plan of the test is such that these differences are not very precisely measured and only the greatest difference, that between two and six irrigations is statistically significant. However it is probable that four irrigations in 1939 were insufficient to produce maximum yields in this test. The differences in quality of the beets receiving the different irrigation treatments are not very great, but the beets receiving less water had slightly higher percentage sucrose. Pounds of sugar per acre follows the trend of the yield of roots.

When spacings are considered the differences in yield are not very great, but the greatest difference is statistically significant and it is probable that 20 inch spacing resulted in too small a plant population for maximum yields in this test. It is also possible that in this test the yield from 8 inch spacing was better than from 14 inch spacing since the difference in yields of roots and sugar per acre just equal or slightly exceed the amount necessary for statistical significance. While the differences in sucrose percentage are not great it is probable that the beets from the heaviest plant population, 8 inch spacing, were superior in this respect.

On the basis of the F value differences attributable to the interaction of spacings and irrigations appear to be negligible with the exception of percentage sucrose. The summary indicates that low percent sucrose appears to have been associated with 2 irrigations and 20 inch spacing and with 6 irrigations and both 14 and 20 inch spacing. A suggested explanation for the first case is that excessive drying of the plant late in the season interfered with the processes of sugar manufacture and storage (while there is no proof, the wider spacings appear to suffer more from lack of water than do the closer spacings as judged by the appearance of the plants). The lower percent sucrose of the beets from the wider spacings which had an adequate water supply appears to be the usual association of low percent sucrose with vigorous and maximum growth of the individual plant.

In 1936, 1937 and 1938 the spacing and irrigation test had spacing intervals of 8, 12 and 16 inches and in these years harvests of normally competitive and all beets on the plot were made. A comparison of yields calculated on each basis indicated that some systematic error was introduced when yields were calculated from normally competitive beets from different spacings (see previous reports). After it was decided to make a change in the spacings used for this test in 1939 the data from all three of the above tests for sucrose percent and actual yields of roots and gross sugar per acre was combined for a complex analysis of variance. Summaries of the combined data for the spacing and irrigation tests for the years 1936, 1937 and 1938 follow: