30-cm layer are described in Fig. 4. The values are low and almost identical at a distance of 0-5 cm from the tricklers. They then increase, reaching a max at 35 cm from the water source. The increase in total salts content, expressed by the electrical conductivity, was moderate as the distance from the tricklers became greater. The increase in Cl content was linear up to a distance of 35 cm from the tricklers, and as mentioned, the soil salt content was max at this distance.

Plant mineral content. Determinations were made of the sodium, potassium and chloride contents in the corn leaves (Table 1). There was no statistically significant effect of the plant distance from the tricklers. There was a general increase in Na until 35 cm and conversely a decrease in Cl content until the same distance. There was no clear trend of K in either direction.

Discussion. Various irrigation methods, particularly sprinkle irrigation, are designed to achieve uniform conditions of soil moisture and salinity over the entire crop area. In the case of trickle irrigation, the purpose is to create favorable growing conditions on part of the field and to arrange the plants within this defined area. Thus, information concerning the effective width of the wetted strip and its main characteristics is of basic importance in the proper application of the trickle irrigation method. In the present experiment conducted in sandy soil, there were no differences in rate of vegetative growth between plants located at distances of 0-35 cm from the trickle line. At 50 cm however, the growth rate was reduced. Yield response to distance was more pronounced, that is, to the conditions prevailing in the immediate vicinity of the root zone. It seems that plants located too close to the tricklers (0-5 cm) suffered from poor aeration, and did not produce max yields despite the low soil salinity in this region.

Under conditions of sandy soil and saline water, the period of time during which the plant experienced a certain water tension is a factor of much significance, even when the tension is relatively low. Fig. 5 shows the yield as a function of the total soil water tension during an irrigation cycle of 24 hr. A rather moderate optimum curve is obtained. At least part of the lack of response can be attributed to the experimental conditions which allowed the roots to develop to distances from the water source which differed from those at which the plants themselves were located.

The difference between Cl movement and the movement of total salts in the soil is clearly seen in Fig. 4. This is due to the irrigation water's composition, resulting in a tendency for the soil to become saturated with gypsum which is a major component in the measurements of electrical conductivity of the soil extract using a high soil:water ratio of 1:1. The movement of highly unsoluble salts is unlike the movement of readily soluble chloride salts. This is the reason for the different conc lines in Fig. 4, where in both cases the max values are obtained at the edge of the horizontal wetting front, at a distance of about 35 cm from the trickle line.

Irrigation by trickling demands location of the plants in the field in a manner suitable for the wetting pattern. This factor is of even greater importance in the case of sandy soils with a low capillary. In the present experiment, the optimum plant distance was found to be 5-25 cm from the trickle line. Within this range, a proper combination of soil growing conditions was provided which resulted in max plant growth and yield.

Literature Cited

Relationship Between Surface Color Development and Total Soluble Solids in Papaya

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Abstract. Using the pure juice of 1/2 fruit for soluble solids determination, it was found that for freshly harvested fruit to meet the min % soluble solids (SS) of 11.5 required by Hawaiian grade standards for marketable papayas, the fruit should have at least 6% surface yellow coloration. Postharvest ripened fruit, the min degree of surface coloring when harvested should be at least 3% for the ripened fruit to meet the min soluble solids (SS) requirement. Because the 6% surface coloration is more readily visible than the 3% level in the papaya orchard, the higher stage of coloration is recommended as a index for min harvest maturity.

The State of Hawaii wholesale and consumer standards for Hawaiian papayas require that in a given lot of fruits, the % total soluble solids (% TSS) of the edible pulp juice average not less than 11.5, provided not more than 10%, by count, of the fruits in the lot have % TSS of less than 10.5 (2). This requirement applies to all fruits offered for wholesale or retail sale regardless of the stage of ripeness when sampled by authorized regulatory inspectors. It applies to fruits held in storage or to be exported as well as to freshly harvested fruits offered for sale. How to meet this requirement with respect to stage of ripeness of fruit as determined by surface yellow color development when harvested is the object of this study.

Fig. 4. Soil salinity at different distances from the trickle line, in the 0 to 30-cm layer (measured in 1 soil : 1 water extracts).

Table 1. The concn of certain mineral elements in corn leaves, in relation to distance of plants from the tricklers.

<table>
<thead>
<tr>
<th>Plant distance from tricklers (cm)</th>
<th>Element concn (mg/100 g dry matter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na</td>
<td>K</td>
</tr>
<tr>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>5</td>
<td>3.7</td>
</tr>
<tr>
<td>10</td>
<td>3.7</td>
</tr>
<tr>
<td>25</td>
<td>3.6</td>
</tr>
<tr>
<td>35</td>
<td>4.1</td>
</tr>
<tr>
<td>50</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Fig. 5. The relation between corn yield and soil water tension during an irrigation cycle of 24 hr.
investigation.

Mature fruits of the papaya (Carica papaya L. cv. Solo) of various stages of surface color development (3-100% yellow) were used in % TSS determinations immediately after harvest or after treatments followed by ripening at 72-74°F. The degree of surface yellow coloration was determined visually. Treatments included hot water, fumigation, and hot water + fumigation. The standard hot water treatment currently used in the industry to effectively control storage decay in papaya shipments without altering the flavor or aroma consists of submersion of fruits in water at 120°F for 20 min, then cooling in running tap water for 20 min (1). Fumigated fruits were treated with 1/2 lb. of ethylene dibromide per 1,000 cu ft of fumigation chamber space at ambient temperature for 2 hr, followed by airing for 1 hr. This is standard disinfestation treatment for export papayas (3). For the combination treatment, fruits were fumigated immediately after the hot water treatment.

For the determination of % TSS, the fruit was halved longitudinally in the middle, equalizing as much as possible the degree of surface yellow coloration on both halves of the fruit, and deseeded. For ripe fruit, the edible pulp was removed with a spoon, but for unripe fruit, the peel was removed with a knife and the pulp was sliced into strips. In both cases, the pulp was pureed in an “Oster Juicer” (Model 345). The puree was then clarified by filtering through a double fold layer of “Kimwipes” tissue. A drop or two of the filtered puree juice was placed on the prism of a calibrated Bausch and Lomb, Model CB9487, hand refractometer (0-25% range) and the % TSS determined. When comparisons were made between the puree of 1/2 fruit and that of the whole fruit, after the % TSS of the 1/2 fruit was determined, the puree was mixed with the puree of the other 1/2 fruit and the % TSS determined again. Moisture content of the puree was determined by the conventional drying procedure and pH was determined with a Coleman Metron III pH meter.

In initial tests, the % TSS of the puree juice of 1/2 fruit was compared with that of the whole fruit. Fruits of various stages of surface yellow coloration were used immediately after harvest and after ripening at 72-74°F. The resulting correlation coefficient (r = +.974) was highly significant (P = 0.1), indicating the reliability of 1/2 fruit for % TSS determination. Thus in ensuing
tests only 1/2 fruit samples were used.

For % TSS determination immediately after harvest, fruits ranging in yellow color development from 3-100% were used in 8 tests. As indicated in Fig. 1, the % TSS of the puree juice of fruits analyzed immediately after harvest increased with the increase in surface yellow coloration up to the 80% color level, then dropped with further color increase. The decrease in % TSS was further investigated in another test. There was no significant difference in the moisture content (ca. 85%) or pH (ca. 5.6) of the pulp in fruits of all stages of color development. Although fruit growth was not determined, it is doubtful that the fruit increased in size after the appearance of surface yellow color, especially after it was more than 80% yellowed. It thus appears that the decrease in % TSS after the 80% color stage is an indication of a possible deterioration due to respiration or movement of soluble materials, especially sugars, away from the fruit while intact on the plant. Since the chief component of quality in papayas is the sugar content, it seems that the optimum harvesting stage for tree-ripened fruits is when they are approx 80% colored.

In a series of 9 tests, fruit ranging in initial surface yellow coloration from 3-67% were ripened up to approx 80% surface yellow coloration at 72-74°F and analyzed for % TSS. The results showed that the % TSS increased with the increase in the initial degree of surface coloration up to about 33% beyond which there was little or no change. This relation was shown by untreated fruits as well as those subjected to the hot water and fumigation treatments and is illustrated for the hot water + fumigation treatment in Fig. 2. Thus it seems that for the development of max % TSS in ripe fruits after harvest, they should be harvested when the surface yellow coloration is at least 33%.

For freshly harvested papayas to meet the State of Hawaii wholesale and retail min grade requirement of 11.5% TSS (2), the fruit would have to be at least about 6% yellowed (Fig. 1). Harvested fruits of 3% color stage and higher ripen normally and their % TSS readily meets the state grade requirement also (Fig. 2). Whereas 3% yellow coloration on a fruit is difficult to discern in the field, 6% yellowing is readily visible in the blossom end region of the fruit. Therefore from the practical standpoint, the min surface color stage for harvest in order for the fruit to meet the Hawaiian min % TSS grade requirement is approx 6%.

Literature Cited