A WATER CONTROL SETUP FOR CITRUS AND VEGETABLES IN THE EVERGLADES

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With a production of 13,000 carloads of vegetables and over one hundred million pounds of raw sugar annually, it is evident that some practical form of water control has been achieved in the Everglades. The popular impression seems to be that this has been done by the state and federal agencies but this is erroneous. No sound agricultural development was possible so long as the gravity canals, dug many years ago, were depended upon for drainage. Also, the multi-million dollar dike constructed by the U. S. Government around Lake Okeechobee may prevent a repetition of the 1928 hurricane disaster in which thousands of lives were lost, but it does nothing to make farming in the 'Glades any less hazardous.

The water control system which makes the present amazing production possible was evolved over a period of years by the land owners themselves by a trial-and-error method. First attempts were in the form of sub-drainage districts, formed and heavily bonded to provide the necessary flood control on certain areas. These first districts underwent the usual troubles of pioneers but a practical answer to the water control problem was eventually worked out. As soon as the control methods were proven feasible by the districts, large numbers of large scale farmers and corporations installed and operated their own systems, patterned on those used by the sub-drainage districts. The present water control system is practically standardized and embraces three main points:

1. Enclosure of the area to be developed by muck dikes and the construction of canals inside the dikes to collect and carry flood waters to the pumping stations. At first, muck dikes were constantly breaking but with improved engineering this trouble has been largely eliminated. Seepage through the dikes is not excessive and they have proved to be a practical form of construction.

2. Large capacity drainage pumps to discharge excess water outside the dikes. These pumps are of various types and sizes but a capacity of 2,000,000 g. p. h. is about average. Present day developments usually are designed to remove about three inches of water in twenty-four hours.

3. The mole drain. The deep, level vegetable and sugar cane lands readily absorb large volumes of water, and once saturated, are difficult to dry out. The same slow lateral movement of the water through muck which made the muck dike possible also made drainage of excess water into the canals so slow that only the edges of fields adjacent to canals had any real protection. The mole drain was the answer to this problem. As its name implies, this is a mole-like opening in the subsoil, formed by a clumsy looking but efficient machine, the essential parts of which are a steel blade which can be inserted vertically into the muck to any desired depth and a metal plug or "mole," about six inches in diameter, attached to the lower end of the blade. When this machine is drawn across the field by a heavy tractor, the plug compresses the semi-plastic subsoil to form an opening which remains after the passage of the mole. These drains discharge into open ditches and function the same as the conventional tile drain. Spacing of these drains varies, but average depth below the ground level is about two and one-half feet. Distance apart will vary from ten to

twenty feet. Under favorable conditions these moles will remain in serviceable condition for several years but growers of annual crops as a rule "mole" their lands each season.

At first water control was confined to providing drainage, but with the expansion in the growing of celery and other crops requiring irrigation growers rapidly became irrigation conscious and most developments now have some provision for pumping water into their canals for distribution through the soil by the moles.

An entirely different problem is the development at Port Mayaca, primarily devoted to orange groves. This is very irregular land, including all types of soil from muck to flatwoods sand. It has a general slope from northeast to southwest with an extreme difference in elevation of about ten feet. Five hundred acres of the total six hundred in Valencia oranges are planted on an intermediate type of soil which originally had from a few inches to a foot of muck underlaid with sand but which after plowing and bedding for grove resembled a sandy hammock soil. The slope of this land as well as its impervious subsoil of marl and rock makes any kind of sub-irrigation impossible and drainage is entirely by surface runoff.

The canal layout consists of a main north-and-south canal, discharging into the St. Lucie canal, dug on the approximate dividing line between those lands which can be normally drained by gravity and those so low that drainage must be by pumps. Four east-and-west lateral canals intersect the main canal at intervals of one-half mile. Spillways are provided wherever necessary to compensate for differences in elevation, and electrically driven lift pumps raise water for irrigation to each level as required. By means of these spillways and pumps, and equalizing canals connecting laterals on each level, it is possible to maintain a reasonably uniform water level in all canals in both wet and dry weather. Drainage of the area too low for gravity drainage is by means of four small pumps, installed at three points with a combined discharge of 2,000,000 g. p. h.

Irrigation water is supplied by a primary lift pump of 900,000 g. p. h. capacity, which irrigates all groves on the first level and furnishes water for the secondary lift pump of 600,000 g. p. h. This irrigates all groves on the second level and supplies water for the third pump of 350,000 g. p. h. These pumps have supplied adequate water for long dry periods, although in extreme cases it is necessary to operate them on a 24-hour-day basis.

The unit of development is a twenty acre tract, 660 by 1320 feet, with each tract fronting on a lateral canal for 660 feet. Each unit is surrounded by a ditch dug by a dragline, the spoil from which combined with that of the adjoining tract forms a dike and roadway around the unit. As the land slopes from the east to the west, the east ditch is used primarily for irrigation and the west ditch for drainage. To facilitate both drainage and irrigation the orange trees are planted on low beds running with the slope from east to west.

A permanent wood box type pump is mounted in the middle of the canal so that one pump can serve two tracts. Each tract is connected with the pump by means of an 18" culvert through the canal bank at an elevation low enough to permit gravity drainage through the culvert and pump box. An outlet gate in the side of the pump box is provided for the discharge of drainage water. By means of a single steel gate in the pump it is possible to pump into either tract at will, or to pump into both tracts at once. In irrigating a grove tract, the pump is driven by a tractor on the canal bank and water forced by means of a concrete control box in the field ditch to flow into the irrigation ditch. This ditch is closed at the end of the field furthest from the pump, so the water level rises until it is high enough to flow into the water furrows between each two tree rows. As the ground is kept covered by

a dense growth of grass and cover crop, movement of the water down the slope is very slow and it spreads out until about half the space between the tree rows is covered. When water from the majority of furrows begins to flow into the drainage ditch, which will normally require from four to nine hours, irrigation is considered complete. Water is held in the tract by a steel gate in the control box until the next day, when the gate is removed and the excess water drained back into the canal. As the pump will deliver about 250,000 g. p. h. at the average heads, total water applied at an irrigation will run from one to two million gallons, depending upon conditions. Due to the cover crop there is no erosion problem.

Cost of electricity for operation of lift pumps will run about a dollar a million gallons for each lift. Labor and fuel cost of operating tractor pump will approximate $4.00 per million gallons, which gives a total cost of five to six dollars per million gallons, depending on whether it is first or second level. This is operating cost only and does not include maintenance, depreciation or overhead.

Orange production of this grove for the current season was about 120,000 boxes.

SALTINESS IN IRRIGATION WELLS

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Where available, artesian waters have been used for irrigation and spray purposes on citrus and other crops in some sections of Florida, such as the upper east coast, for about 70 years. As early as 1900 (4) there were reports of damage to citrus and truck crops in some cases when irrigated with artesian waters in the upper east coast sections. In other cases no damage was apparent even after using artesian water for irrigation on citrus for 8 or 10 years. Some growers observed considerable difference in the mineral content of water from various wells and advanced the theory that the damage was caused by salt in the water. However, in the absence of analysis of the water nothing definite was determined as to the actual cause of the damage.

When the salt content of water reaches a concentration of 1000 to 1500 p.p.m. it becomes apparent to taste by the average person. Within the past decade or so some growers have observed an increasing saltiness to the taste of their artesian water. This observation, combined with a few analyses made at irregular intervals during the past 15 or 20 years, seems to indicate that the salt content of many wells is gradually increasing, particularly in the older developed artesian areas where a great many wells are in use. One such area is the Cocoa-Merritt Island section. Here many wells which once produced relatively fresh palatable water are now distinctly salty to the taste, some of them analyzing over 2000 p.p.m. as NaCl (Table 1). Farther south in the Vero Beach-Ft. Pierce area a great number of artesian wells for irrgation purposes were not put down until rather recently, perhaps during the past 20 years. Analyses made annually for the past three years show that a great majority of the