HORTICULTURE NOTE NO. 23

DESIGNING A VEGETABLE FARM

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ABSTRACT

Commercial vegetable farms should be designed properly for good crop management during the growing season. Fertilizers, insecticides, fungicides, herbicides and irrigation can be effectively applied to obtain good quality produce. The land can be better managed for sustained vegetable production.

INTRODUCTION

For commercial vegetable production, it is important to design and layout the plots in the farm for effective application of irrigation, fertilizers, pesticides and to exercise good post harvest handling of bulk vegetables harvested from field plots. The farmer or farm manager will be able to plan for the next seasons crop by rotating crops between plots in the field to minimize build-up of root diseases and nematodes. With good farm layout, the land will be better utilized for sustainable vegetable production.

This horticulture note is intended for commercial vegetable farmers in the Central Province as particular reference is made to the Vegetable Extension Programme being coordinated by DAL Food Management Division and the Taiwanese (ROC) Agriculture Technical Mission to Papua New Guinea in the Tubusereia area. However, some basic information provided can be modified to suit specific conditions for vegetable production throughout the country.

LAND PREPARATION

After clearing virgin or old farmland, it is advisable to plough the land and leave for up to one month depending on the weather condition. During the wet season the period may be less than a month before actual field preparation for growing vegetables. The practice of ploughing and exposing the land for some time helps to destroy unwanted soil organisms such as the cutworms (*Agrotis ipsilon*) by starvation. Cutworms chew off young seedlings at or just below soil level.

Fresh chicken manure and basic fertilizer can either be applied on the land before ploughing or applied after the land has been ploughed and harrowed, then mix into the soil by a rotovator or small tiller. But more chicken manure and fertilizer may be required for both these methods. The third method is to apply fresh chicken manure and basic fertilizer onto the beds and add water to ferment the fertilizers. After about three days this should be mixed using a power tiller before transplanting or direct sowing. For effective utilization of the inorganic fertilizer (NPK) it is recommended that this be applied into the planting holes only.

The field must be prepared to a fine finish using tractor drawn implements such as plough, harrow and rotovator. A ridger should be used to form beds and a plough to form watermelon beds at recommended spacings.

DESIGNING A FURROW IRRIGATION SYSTEM

Designing a furrow irrigation system for vegetables enables an efficient application of water between crops planted in rows. This is achieved by releasing an equal amount of water down each furrow from a slightly elevated canal or supply ditch at the end of the field. A recent development is the use of PVC pipes with small controlled outlets fitted to supply field plots through a small supply ditch. The system has been tested by the Taiwanese (ROC) Vegetable Extension Team and is very useful in the Central Province.

Furrow Shapes and Sizes

Many different shapes of furrows are used for different crops. The furrows can be spaced farther apart in soils which allow easy lateral movement of water, such as in light or layered soils. Soils which take water slowly require larger furrows so that there is a large area of watered soil. Shallow-rooting crops will

need shallow furrows at close spacing; deep-rooting crops will need deeper furrows and can be far apart. Flat-bottomed or round-bottomed furrows are better than V-shaped furrows.

In Central Province bed sizes were mechanically constructed to suit the types of vegetables that were grown. A standard size bed to use for most vegetables except watermelons, and wax gourd should be 1.25 metres wide. Furrows should be made between beds to allow water to flow through freely. Watermelon beds are spaced 7 or 8 metres during the dry and wet season respectively. One row of watermelon is planted on either side of the beds. The growing vines are guided into the centre.

Length of Furrow

The best length for furrows will depend on the soil type and slope. If the furrow is too long the top end gets water-logged, but if it is too short this means more supply ditches and more interference with mechanization. If the gradient is very flat the water does not move quickly enough down the furrow and if it is too steep there is danger of soil erosion. Therefore in both these cases the length should be shorter than in the case of an ideal slope which is about 0.3 percent. Soils with high infiltration need short furrows because the water would sink in before reaching the far end of the furrow.

Grade of Furrow

Furrow irrigation is most efficient on gentle uniform slopes where precise furrow grades can be obtained without too much leveling. The optimum furrow gradient is from 0.15 to 0.3 percent on heavy soils, and 0.3 to 2.0 percent on medium textured soils. Furrows can be used on grades up to 5 or 6 percent but will promote soil erosion.

It is important to test the irrigation system to make sure water is flowing and filling up the furrows properly before planting.

Advantages of Furrow Irrigation

1. Large areas of the vegetable farm can be irrigated quickly compared to other systems such as sprinkle irrigation.

2. Water can be controlled by temporary earth bunds or by using stoppers if PVC pipes are used.

3. Evaporation is less than when the whole surface is flooded.

4. Unnecessary weed establishment is minimized.

5. Flowering of vegetables such as tomato, watermelon and capsicum is not affected. Sprinkle irrigation is likely to disturb flowering and fruit set of these vegetables.

6. The installation cost is reduced. Compared to sprinkle or drip irrigation systems where pipes and sprinklers have to be purchased or replaced if not looked after properly.

7. There is less danger of puddling in heavy soils.

8. The method is suitable for a wide range of soils and slopes.

Possible Disadvantages

1. Not suitable under saline soils and/or where saline water is used for furrow irrigation.

2. High labour requirement if not mechanized.

After transplanting, the young seedlings should be watered from the furrows by using empty containers. Once plants have been established, irrigation through the furrows is sufficient. Irrigation is required 1 to 2 times a week. It is necessary to make drains around the farm to remove excess water. Too much water will affect plant root development and may also promote diseases.

Recommended Bed Size

The recommended bed size for most vegetables using furrow irrigation is 1.25 metres.

Watermelon beds should be 7 to 8 metres wide during the dry and wet season respectively. For pumpkin and wax gourd the bed size should be doubled that of watermelon.

Recommended Plant Spacing

During the dry season and in poor soils use the lower range spacing and the high range during the wet season and on fertile land. The spacing given in the table is recommended under Central Province conditions and may be adjusted for other areas in the country depending on the soil and climatic condition.

Head lettuce and cabbage should be raised in a

nursery tray or other temporary field nursery bed, then transplanted into nursery pots before field planting. This increases the survival rate of the plants in the field. Cucumber, yard long bean, watermelon and wax gourd should be thinned to one healthy seedling after field establishment.

The best time to transplant is in the evening. Water the young seedlings from the furrows using small containers. Irrigation should be provided 2 times for the first two weeks. After seedling have established, irrigation is required 1 or 2 times a week depending on the soil structure and weather condition.

Temporary shade maybe required for the first week after transplanting but is usually not necessary.

The table below outlines some recommedations for vegetables and the spacings available to us.

Crop	Spacing	Type of Planting
Tomato	75-90 cm	Transplanted
Capsicum	75-90 cm	Transplanted
Head Lettuce	75 cm	Transplanted
Head cabbage	75 cm	Transplanted
Eggplant	75-90 cm	Transplanted
Yard Long Bean	1 m	Direct planting
Cucumber	1 m	Direct planting
Wax Gourd	1.5 m	Direct planting
Watermelon	1.5 m	Direct or transplanted

Grass mulch should be used to cover the soil around the base of the plants to control weeds and reduce soil moisture loss.

PEST AND DISEASE CONTROL

Protective application of insecticides and fungicides may be required during the early stages of crop establishment. Young plants should be sprayed weekly. After about four weeks, spray only when necessary.

The cucurbits (watermelon, pumpkin, wax gourd and cucumber) are affected by the cucurbit leaf beetle. If not controlled the beetle will destroy the leaves of the young plants. For effective chemical control Carbaryl or Orthene are recommended for use. If wire net is available this should be used to protect the young seedlings from the cucurbit beetle. Remove the net once the plants have established.

For capsicum, tomato, eggplant and watermelon, chemicals such a Karate or Furadan should be applied around the planting holes to protect young plants from cutworm or cricket damage. Furadan is available as granules, soluble powder or in liquid form. A bait made from 100 ml Malathion 50% EC to 1kg layers' mash and mixed with enough water can be used to control crickets where severe damage occurs. The paste is applied around the seedlings late in the afternoon after transplanting.

Cultural control of cutworms can be achieved by ploughing and exposing the land for some time before final land preparations.

ACKNOWLEDGEMENT

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FURTHER READING

Hudson N.W. (1983). Field Engineering for Agricultural Development, Oxford University Press, New York.