Tomato Growing in the Wapenamanda Subdistrict

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Growing good tomatoes consistently is possible if the grower is willing and able to maintain a high level of management. More so than any other crop in the experience of the author, tomatoes will respond to good management, but results will be poor without it. The author has grown tomatoes in four different areas in the Wapenamanda Subdistrict. All areas were near 5600 ft above sea level.

Climatic Conditions

Trials now in progress are expected to show advantages for certain varieties at different times of the year. The main factor is the amount and timing of water available. A 4-year average rainfall at Wapenamanda showed 100.72 in annual rainfall with a high month of February (13.65 in) and a low month of July (3.36 in). The averages are deceiving in that we often get long periods without any rain. During July and August, 1971, we experienced a 4-week period without rain, and irrigation was necessary at that time for plants less than 6 weeks old.

Ground Preparation

Soil broken from pasture or bush will rarely produce a good tomato crop in the first year. I suggest planting a crop of sweet potato initially and at the same time incorporating 1 ton per acre of limestone ($CaCO_3$). After removal of the sweet potato, the ground should be ready to plant tomatoes. Tomatoes do not like wet feet, so careful attention should be given to drainage.

PLANTING PROCEDURES

All tomatoes are started in the greenhouse in a medium of ½ coffee hulls and ½ black soil (by volume). Pre-planting fertilizer per box is—

- 1 tablespoon limestone
- 1 tablespoon triple superphosphate
- 2 tablespoon ammonium nitrate

One tablespoon of seed is scatter-planted in one box and transplanted when 1 to 1½ in tall to other prepared boxes at a 2 in by 2 in spacing (64 plants in a box 18 in by 18 in by 3 in). Only water is given during the sprouting period. After sprouting and until transplanting outside, 1 quart per box per day of the following mix is given:—

- 44 gal water
- 1/3 cup muriate of potash
- 1/3 cup magnesium sulphate
- 1/3 cup di-ammonium phosphate (20 per cent N, 21.8 per cent P)
- 2/3 cup ammonium nitrate

If damping off becomes a problem, use a seed sterilant, e.g. Panogen.

Transplanting (Greenhouse to Garden)

The optimum time to plant outside is when the seedlings are 8 to 10 in tall. Harden the plants by putting the box outside for 3 days before transplanting. Plant in the horizontal-vertical position as follows—strip all the leaves off except the top three, and lay in a trench. Gently bend the head of the plant to a vertical position and cover the horizontal part of the seedling with 1 to 2 in of soil. Leave only 3 to 4 in of the original plant exposed. We use a 30 in by 30 in spacing.

Transplant Mix

Several experiments have proved the value of a transplant mix (starter solution) both in early growth and later production. It includes water plus quickly available plant nutrients plus a fungicide. One mix that has proved successful is as follows:—

- 5 lb ammonium nitrate
- 5 lb magnesium sulphate
- 2½ lb muriate of potash
- 15 lb di-ammonium phosphate
- 2½ lb Zineb 65
- 2½ lb copper oxychloride
- 10 oz sodium molybdate (39 per cent Mo)

Plate I.—The wife of the author assists in the supervision of the work at Mukulamanda Agricultural Centre. Mrs Herman is seen here with Mark Angala, the Chief Garden Supervisor

Of the above dry mixture, 6 oz are mixed with 4 gal of water. Apply 1 pint of this mix per plant at planting time.

Lime

A pH of 6.0 is adequate to grow a good tomato crop and under our conditions it is impractical to try to go much higher. After initial breaking and liming, 1000 to 1500 lb per acre per year will maintain the pH around 6.0. The pH of native soil in the Wapenamanda area is 4.8 to 5.2. Lime is available locally and can be used without further processing.

Fertilizers

The analysis of the fertilizers used is as follows:—

	N	P	K	Mg	S	B
Base	9.7	6.2	14.9	1.39	4.7	0.2
Side Dress	13.6	4.4	17.9	1.81	5.8	0.2

All figures are expressed as percentages of the various nutrients in 100 lb of the mix. In addition to the base, the mix contains 4 per cent by weight of Ess-Min-El (a trace mix from Amalgamated Chemicals).

The optimum level in our trials is—

(1) 3 lb base dress per chain row at planting, plus

(2) 1 lb side dress per chain row 1 month after planting, plus

(3) 1 lb side dress per chain row 2 months after planting.

Other levels of fertilizer (both higher and lower than these) have reduced yields.

Further trials will probably prove the value of higher proportions of phosphorus. The value of a small amount of boron has been proved, but the optimum level has not yet been established.

VARIETIES

Of the many varieties available, 24 have been compared for production and disease resistance using the procedures outlined in this paper. Most have been compared at least twice. A few have proved consistently inferior. They are Marion, Red Cloud, Epoch and Grosse Lisse-45. Further work is required on Grosse Lisse and College Challenger. One of the big opportunities in improving production is to increase the percentage of saleable fruit. Some of our early trials had up to 70 per cent non-saleable fruit. "Non-saleable" here means not acceptable to our local vegetable marketing agency, WASO Ltd, Wapenamanda. This is for a variety of reasons, including small fruit, misshapen fruit, insect damage, soft spots from Blossom End Rot and soft spots from a variety of fungus and bacterial diseases. The largest percentage of non-saleability used to be from damage by Blossom End Rot. This problem has been largely solved by attention to proper calcium levels. Currently all of the above reasons contribute equally to non-saleability and about 30 per cent by weight of all fruit continues to be non-saleable. The yields of saleable and non-saleable fruit in a recent trial are shown in *Table* 1. All were transplanted outside on 1st July, 1970. The harvest period was 16th September to 12th November, 1970.

Hybrids

All the hybrids we have tried have proved inconsistent in production and require a high level of fertilizer and management to get good production. I would not recommend them for inexperienced growers. They could have merit for commercial producers, but they still require further testing.

PESTS AND DISEASES

The two major problems experienced to date are cutworms and tomato fruit worms. Cutworms will cut seedlings off at ground level during the first few days, but can be controlled by spraying a ring around each plant on the ground after planting. Use a 0.18 per cent DDT solution.

Good general control for tomato fruit worm plus several other worms can be obtained by weekly sprayings of DDT plus a spreader activator (both according to directions) until fruit set. After fruit set, Malathion should be used instead of DDT. We find it necessary to use the Malathion at higher than recommended rates to obtain good control.

Fungus and Virus Diseases

Much more work needs to be done to find the most effective ways of reducing the incidence of, and damage from, Anthracnose, Target Spot and Fusarium Wilt. We have compared Zineb, Difolatan, Maneb, Kopi, Dithane M-45 and Phaltan.

For our purposes, Maneb has proved the best and most economical. Phaltan did a good job but is more expensive than Maneb. Difolatan also did a good job while all the others mentioned were inferior. It is quite probable that further trials will alter the above statements. The fungus picture is complicated by variety resistance, plant nutrition and incidence and distribution of rainfall. We have included Captan 83, Ziram 90 and microtomic sulphur in current trials.

Blossom End Rot

This is a physiological disease that deserves special mention. We have found that during the wet season an increased calcium level in the soil will give a reduced incidence of Blossom End Rot. This situation seems to reverse during a severe dry season.

Crop Rotation

In this area tomatoes require special care. A small disease or insect buildup will very quickly reduce yields. Our present rotation of root crop—legume—tomato (or other vegetable)—root crop has given satisfactory results.

STAKING AND PRUNING

Many methods of staking can be used successfully providing they allow for adequate support of a heavy fruiting plant well above the rain splash zone and also allow for adequate ventilation. Bunching (more than one plant per stake) may better utilize available stakes and will also facilitate spraying but care must be taken not to restrict ventilation.

Pruning properly will also help open up the plant to good circulation of sun and wind. We prefer the single stem system with all bottom leaves trimmed so that no leaves are touching the ground. A bottom-trimmed plant will grow taller than one not so trimmed and put the majority of the fruit above the rain splash zone. We also recommend pinching out the lateral growth as soon as buds appear in the axils of the leaves.

CROP HYGIENE

All weeding is done manually by local women. To date no chemical weed control has been attempted. All plant residues of tomatoes are burned when possible, or buried in an area where there are no vegetable gardens. Residues of all other crops are fed to either cows or pigs and the manure (after composting) is returned to the gardens.

Table 1.—Comparison of saleable and non-saleable fruit for different varieties

Variety	Saleable Fruit per Chain Row (lb)	Non-saleable Fruit per Chain Row (lb)
Grosse Lisse	149	62
Manapal	213	80
Marion	129	105
VF-11	127	87

Practical Work for Students

Every agricultural college principal would like to have his college farmland in 'inspection-order' at all times. But if the first goal of the college—the education and training of students—has been displaced by the desire for orderly and successful farming, then the appearance is deceptive, for the college is a failure.

So writes Mr Gordon Dick, D.A.S.F's Chief Education and Training Officer in his paper, 'Practical Work in Sub-professional Courses in Agriculture', published in *Agricultural Education and Training: Annual Review of Selected Development*, FAO, 1971, pp. 24-28.

From his experience at both PATI and Vudal, Mr Dick outlines practical solutions to the problem of giving students the right amount and kind of practical work so that they gain the necessary experience without getting bored or frustrated and without sacrificing time needed for lectures and study. Students will never work happily if they think they are being used as cheap labour; they must feel that the project belongs to them. Or, as Mr Dick puts it, 'the drudgery goes out of weeding and digging if the success of the project belongs to the weeders and diggers'.

The article concludes with a description of the student projects at Vudal Agricultural College. Each final year student has his own research project, which helps to 'develop the student's awareness of the inter-relatedness of organisms and environment, his powers of observation and his initiative and self-reliance in meeting problems'. An article based on one of these projects appears on p. 139 of the last issue of *Harvest*.

A copy of Mr Dick's paper may be obtained from the Central Library, D.A.S.F., P.O. Box 2417, Konedobu.