THE WEST OF SCOTLAND AGRICULTURAL COLLEGE

HORTICULTURAL LABOUR STUDIES No. 3

TOMATO GRADING

A Study of Equipment and Methods

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Research Bulletin No. 39
1967

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SUMMARY

The bulletin describes the results of an investigation into the grading of tomatoes on five nurseries, each using a different system. The output of each is shown, together with the time taken for the various operations and the percentage of grades at each nursery. From the figures, a true comparison of the systems has been built up, on the assumption that the conditions are the same for each, and it is shown that the output of labour, using a machine, efficiently operated, is about twice that of hand grading. Some of the factors which affect the speed and effectiveness of grading are discussed and a comparison is made between baskets and boxes for despatching fruit. Suggestions are put forward for the most effective organisation of the work and possible outputs by the different systems are quoted.

INTRODUCTION

The most important horticultural crop in the West of Scotland is the tomato and since it is entirely a glasshouse crop, it is subject to high costs and has high labour requirements. Growers to-day are faced with the need to modernise their methods to meet an ever increasing competition, so that capital expenditure for labour-saving equipment has to be seriously considered. This is particularly true of tomato grading, for new statutory regulations are shortly to be introduced, which set out grades likely to be stricter than those that they will supersede. Growers may therefore find it necessary to re-appraise their grading methods to ensure the quality of produce that is needed to obtain the maximum income.

A study was made of tomato grading during the summer of 1966, to investigate some of the methods and equipment in use in the West of Scotland, with a view to assisting growers to decide the most suitable system for their own requirements. Five nurseries in Lanarkshire were visited, and the work of grading was observed at each. In each nursery, a different system was used for grading and these were as follows:-

1. Hand Grading,
2. Hand Grading on moveable trays,
3. Machine Grading with home-made helical type grader,
4. Machine Grading with diverging belt grader,
5. Machine Grading with rotary grader.

DESCRIPTION OF SYSTEMS

Grading tomatoes consists essentially of two different parts, quality grading, in which substandards - i.e. roughs, greens, and bad tomatoes - are removed, and grading for size. In the hand systems all the tomatoes have to be handled by an operator i.e. they are separated into the grades individually. In the machine systems, only the sub-standard tomatoes are handled individually, as they are picked off the grading belt or tray; and the different machines provide different facilities for doing this. In the machines, size grading is done mechanically and provision is made for the different sizes to pass into individual baskets or boxes. In the descriptions which follow, it is convenient to distinguish between grading proper and weighing and packing, which form an essential part of the job.

1. Hand Grading

The nursery on which this system was observed was typical of a small scale enterprise and all the work was done by the grower himself. Grading, weighing and packing were carried out on a table in a reasonably well lit packing shed, which was of ample size for the requirements. Tomatoes for market were packed in 12 lb. cardboard boxes which were lined with two sheets of blue paper. The boxes were made up in the evening previous to the grading day. The work was carried out at a steady pace and little or no time was wasted.

2. Hand Grading on Moveable Trays

The equipment used in this system consists of three trays each with round holes in it set one above the other in a wooden framework. The size of the holes is such that Grade A tomatoes only are retained in the top tray, Grade B in the second and Grade C in the lowest tray. The A's are quality graded and removed from the top tray which is slid aside revealing the second tray. The B's are then graded and the procedure repeated for the C's.

The work was carried out by three persons - the grower with one male and one female worker. The two workers operated the grading trays while the grower removed graded baskets from the shelf of the grader, weighed and packed them, and carried them to a corner of the shed to await lidding. He also lined baskets with two sheets of blue paper. Grading was done in the morning and, on the day of our observation, it was finished by noon, and in the afternoon the grower and the female worker lidded the baskets. To do this, the baskets were taken from the corner of the shed back to the packing bench and returned to the corner of the shed again after lidding. The shed was small and cramped and the double journey was necessary because there was not enough room for storing baskets near the packing bench.

3. Helical type Grader

This home made machine consists of a frame on which is set a tray about 5 ft. long and 2 ft. wide, where quality grading is carried out. The tray slopes and tapers, leading into the end of two rollers about 5 ft. long and 4 inches in diameter. Half-inch diameter rope is fixed in a spiral fashion round the rollers, which rotate in opposite directions so as to pass the tomatoes outwards. A grading bar is fixed at the side of each roller, at an angle, so as to form a gradually increasing gap. Fruit passes through the gap into four sloping compartments - small fruit into that nearest the grading tray and larger fruit into successive trays as the width of the gap increases. Baskets are set at the mouths of the compartments to catch the fruit.

Two persons were engaged in grading, the grower, who filled the machine and carried out the quality grading, and a woman, who lined empty baskets with 2 sheets of paper, removed full baskets from the grader, and weighed and packed them ready for lidding. Lidding was carried out as a separate operation later in the day. The grading shed was rather small and the space was barely adequate for convenient working. The two rollers in the machine allowed two grading lines to be operated; one was used for firm or under-ripe tomatoes and the other for ripe ones.

4. Diverging Belt Grader

This consists of a wooden framework with a series of pulleys at both ends round each of which passes an endless rubber belt. The pulleys are placed fairly close together at one end and are spaced wider at the other. As tomatoes fall on to the belts, they are carried along until the gap between the belts is such that the tomatoes fall through. They pass into one of the compartments, according to their size, and the outlets of these open to allow the fruit to pass into a box or basket.

Above the belts is fixed a tray-hopper into which the ungraded tomatoes are emptied. This is set at a fairly steep angle so that the tomatoes run down on to the belts, small fruit falling into a box below. Quality grading is carried out on the tray hopper.

At the nursery where this system was observed, the packing shed was large and roomy so that there was plenty of space available. Three persons were engaged in grading. The grower himself carried out the quality grading at the end of the tray and assisted in filling the grader. A woman worker prepared baskets, with three sheets of paper, on a bench in the far corner of the grading shed. She carried the baskets a distance of about 25 ft. to a heap beside the grader. This worker also emptied baskets of tomatoes into the grader, filled baskets with graded tomatoes at the sizing compartments and took them to a floor stack beside the weighing machine. There, a second woman worker weighed the baskets, packed and lidded them and set them aside to the appropriate stack.

Some time was spent filling baskets at the grader, because the flaps at the sizing compartments were normally kept closed and had to be held open by hand while a basket was being filled.

5. Rotary Grader

This is composed primarily of a fairly flat cone supported on a stand and rotating in a horizontal plane. It is fed by a 5 ft. long belt on which quality grading is carried out, and this in turn is fed from a tray-hopper into which the baskets of ungraded tomatoes are poured. On the framework near the circumference of the cone are fitted six adjustable sizing bars arranged so that the gaps between them and the cone increase in size in the direction of rotation. When the cone rotates, tomatoes move to the circumference and pass into one of the grade compartments. From there, they go through the outlet flap into a box or basket.

At the nursery where this system was in operation, the grader had been installed only a few weeks previously and since adequate working instructions had not accompanied it, the staff were not operating the machine in the most effective manner. The packing shed was too small and there was not sufficient room to move round the grader. Thus, under more favourable conditions the output could have been greatly increased.

Three persons were engaged in grading - all women members of the grower's family. The manpower requirements of the machine were such that all three workers were required to operate it. A batch of baskets was graded and then the machine was stopped while the workers weighed and packed baskets and boxes. 12 lb. cardboard boxes were used for tomatoes being sent to market, but fruit for local sale was packed in 12 lb. baskets.

When operating the machine, one worker was fully engaged on grading at the belt. She was assisted by another worker who also filled the hopper with tomatoes and occasionally helped in taking off graded boxes. The third worker was employed filling boxes or baskets with graded tomatoes. Again the flaps of the sizing compartments were kept closed and the baskets and boxes were filled by hand. While the machine was idle, in addition to weighing and packing, workers made up boxes, which were not papered, and lined baskets with three sheets of paper.

BASIC INFORMATION

Some of the data obtained from the observations is given in Table I. This shows the grades, output, and details of times taken at each nursery on the day of the observations.