

ON THE EFFECT OF POTASSIUM PERMANGANATE ON THE GROWTH, FLOWERING AND FRUITING OF *CICER ARIETINUM* L.

BY

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Introduction.

Early in the year 1928, while at Benares, certain preliminary experiments were performed with a view to see the effect of Potassium permanganate on the general growth of pea (*Pisum sativum* L.). The results* then obtained, appeared to be sufficiently interesting; so, on my arrival at Coimbatore, the experiment was repeated on gram (*Cicer arietinum* L.) on a more extensive scale which involved nearly the whole life-history of the plant. These experiments have yielded some interesting results with special reference to flowering and fruiting and are in conformity with my previous results on *Pisum sativum*.

Historical.

The importance of Manganese as an essential element for plant growth, has long been recognised by several investigators and a review of the earlier work has been drawn up by Brenchley (6).

Bertrand (3), while making analysis of plant-ash, came to the conclusion that Manganese is an important factor in plant economy and that it has certain relations with the oxidases, but this was not supported by adequate experiments.

Loew (7), Aso (1), Loew and Sawa (12), Bertrand (4) and others in their work on Rice and other crop-plants, gave the name to the stimulating action of Manganese salts as *catalytic*.

Aso (2) in his earlier work on water and sand cultures, has noted a stimulant action of Manganese in high dilution.

In 1914, Maze (8) showed that Manganese as well as other substances are necessary for the growth of Maize. McHargue (9) also arrived at the same conclusion from independent experiments.

Schreiner and Dawson (13) and Miller (10) have confirmed this in pot culture experiments on Tomato and other plants.

* The results of my experiments on pea (*Pisum sativum* L.), will shortly be published elsewhere.

Bishop (5) has also found that Manganese is necessary in sand-culture of Maize, Pea, Bean and Radish.

Sommer and Lipman (15) and Sommer (14) attached so much importance to Manganese in plant-growth that they used this element in nutrient solution of water-culture.

That the deficiency of Manganese produces chlorosis, has been noted by all the above mentioned authors; and it has recently been confirmed by Samuel and Piper (11).

From the above short resume, it is apparent that all these authors in their experiments neglected entirely the study of the root, flowering and fruiting of any particular plant. The Manganese salt used by them has been some different salt but not Potassium permanganate which has been used by the present author with great advantage.

Experimental.

Procedure :—Series of experiments were performed in ordinary garden soil in tile pots. A tile pot consists of two tiles placed face to face and tied together with a thread and supported on a round or square disc, so that the soil contained therein may not be washed away in watering (figs. 3 and 4). One great advantage in using these pots, is that the study of the root can be done periodically on the same specimen without much damage to the roots. When this is needed, the thread is cut away and one of the tiles is gently removed and the whole thing is then transferred to a tub of water where the root-washing is completed with the greatest ease without the help of any such elaborate root washing apparatus, e. g., the knapsack sprayer. After necessary observations the plants may, however, be replanted if further readings are needed on the same specimens. In replanting, great care has to be observed. The two halves of the tile-pot are first tied face to face with a strong thread or wire. The roots of the plant are suspended in the centre and the soil is then slowly and uniformly added from the sides till the roots are fully covered with it. Lastly, water or Potassium permanganate solution is poured on the soil so that whole of it is fully saturated.

Before actually starting the experiments, tile-pots were first made ready with the necessary earth (garden-soil) in it and were kept in two sets (each consisting of six pots), the first set acting as control and the second as experimental pots. Whenever these pots were watered, equal measured volume of water was added.

The experimental pots were watered with Potassium permanganate solution (0.5 gram in two ounces of ordinary water) and the controls with ordinary water.

The earth in two sets of pots was thoroughly soaked with their respective solutions before sowing.

In each, seventeen gram seeds* were sown (on 4-11-1929), all on the same day and the observations continued. Watering was done every alternate day and the experiments were continued for twenty-six days.

Shoots and leaves: There was not much difference, so far as the overground vegetative parts were concerned. In fact in both (experimental and control) they were nearly similar (figs. 1 & 2). This, however, is not in agreement with the observations of Samuel and Piper (11). One very noticeable feature was that the experimental plants had much darker green leaves than the controls.

Root-system: The study of the root-system was made from time to time as outlined above. The first observation was made on the 21st day (fig. 1), as follows:

Experimental plants :	average length of roots	...	15 inches.
Control plants :	" " " "	...	10 inches.

These plants were replanted as usual with proper precautions and the observations on the very same roots were taken after four days (fig. 2). They are as follows:—

Experimental plants :	average length of roots	...	16.2 inches.
Control plants :	" " " "	...	11.0 inches.

It will be seen from the above records that during four days, the roots in each case increased by nearly one inch. Of course, the experimental plants had slightly longer roots but, on the whole, the difference between both the root-systems was quite appreciable.

Bud-formation: The experimental plants were earlier to bud and at any particular time, it was found that these had certainly more vigorous buds on them than the controls.

Flowering: The first flowers were found on 16-12-29 on the experimental plants while the control plants had none. The first flowers on the control plants were found on 27-12-29, that is, 11 days later as compared with the experimental plants.

Fruiting: Early flowering certainly ensures early fruiting. This expectation was amply fulfilled in the case of the experimental plants. The difference in fruiting between the experimental and control plants was 11 days.

* Thinning was, however, done after the seedlings had fully established themselves in the soil.

Summary.

This short paper embodies the result of the effect of Potassium permanganate (0.5 gram to every two ounces of water) on the general life-cycle of *Cicer arietinum* L. The following results were obtained.

Potassium permanganate treated plants as compared to the control showed :—

- (a) Longer root-system.
- (b) Much darker green leaves.
- (c) Earlier bud formation.
- (d) Earlier flowering.
- (e) Earlier fruiting.

An easy method for the study of the root-system throughout the ontogeny of a plant is described.

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Explanation of the Plate.

Fig. 1. Plants on left treated with Potassium permanganate, those on the right being controls.

Fig. 2. The same plants four days later.

Fig. 3. Plants growing in a tile-pot.

Fig. 4. A tile-pot shown disjoined after root-washing.



1



2



3



4 2 LBS. X 18