University of Groningen

The influence of salts on the exudation of tomato plants

van Andel, Olga Marie

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version

Publisher's PDF, also known as Version of record

Publication date:

1953

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

van Andel, O. M. (1953). *The influence of salts on the exudation of tomato plants*. [Thesis fully internal (DIV), University of Groningen]. North-Holland Publishing Company.

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

viscosity was minimal by day. This rhythm could be maintained over several days. Changes in the periods of illumination could influence the time at which maxima and minima occurred. VIRGIN demonstrated that the changes in viscosity ran parallel to those in permeability under certain circumstances. It seems possible to explain the changes of both water and salt transport as a result of changes in viscosity. However, there is nothing known as yet about the occurrence of such changes in the plasma of root cells.

V. SUMMARY

Starting from the supposition that the exudation is the result of a transport of salt to the vessels the salt secretion was investigated under various circumstances. For this purpose the rate of exudation was determined continuously, while the osmotic value of the sap was determined at certain instants. Also in some cases the water conductivity of the roots was determined. In most experiments tomato plants were used. Some experiments were repeated with *Sanchezia nobilis*.

The influence of the salt concentration of the medium on the salt secretion was studied first. Lowering the salt concentration of the outer solution caused a decrease of the rate of exudation, the course of the change depending on the extent to which the osmotic value of the medium had been simultaneously altered. From changes caused in this way it was concluded that the salts given off to the vessels must come partially from the root cells, while another part must have been transported directly to the vessels after having been taken up from the medium. If salts are present in the medium the latter process causes an increase in the exudation, but only if nitrates and chlorides are included. The importance of these anions for the exudation was demonstrated by determinations of the composition of the exudation sap. It appeared moreover that transport of phosphate to the vessels takes so much more time than that of nitrate and chloride that it suggests a different method of transport. The presence of nitrate or chloride in the outer solution always caused an increase in the exudation, no matter what cations were present.

The exflux of salts from the tissue — the tissue secretion — as well as the transfer to the vessels of salt taken up from the medium — the uptake secretion — was inhibited by inhibitors like potassium cyanide, dinitrophenol, sodium arsenate, sodium fluoride, iodo acetic acid and moreover phenylurethane. This indicates that both processes partially coincide. Their common part might be the transport of salts through the symplast. The water conductivity was also affected by these substances.

Sugar proved to promote the exudation only if salts were present in the medium.

The fact that the tissue secretion depended on the osmotic value of the medium led to the supposition, that salt and water are given off together from the tissue. An osmoregulation of the movement of

water must take place, influenced by the osmotic value, sucked in by the vessels. This was not possible if the osmotic value was not possible. The changes in the osmotic value are also transported to the vessels. The changes in the osmotic value of the sap are also transported to the vessels. The changes in the osmotic value of the sap are also transported to the vessels.

Rate of exudation. The rate of exudation of the roots was shown to be influenced by day, a minimum occurring at which maxima occurred. The experiments of VIRGIN showed that the rate of exudation was influenced by the osmotic value of the sap.

The changes in the osmotic value of the sap are also transported to the vessels. The changes in the osmotic value of the sap are also transported to the vessels. The changes in the osmotic value of the sap are also transported to the vessels. The changes in the osmotic value of the sap are also transported to the vessels.

- ALBERDA, Th. 1948. Uptake of maize p 541—601.
 ANDEL, O. M. VAN. 1951. by means of the tl Akad. Wet. Ser.
 ANDEL, O. M. VAN. 1952. sugar on growth 159—71.
 ARISZ, W. H. 1945. and their transp 48 : 420—46.
 ARISZ, W. H. 1947. leaves of Vallism Ned. Akad. We
 ARISZ, W. H. 1948. leaves of Vallism Vacuole secretio
 ARISZ, W. H. 1953 : 109—30.
 ARISZ, W. H. 1954. chloride-ions in
 ARISZ, W. H. 1955. V. Influence on Bot. Neerl. 2 :
 ARISZ, W. H., R. in tomato plant
 ARNOLD, A. 1955. Wurzeln. Prot
 BALDES, E. J. ar struction and

water must take place afterwards, the osmotic value of the sap being influenced by that of the outer solution; that is to say that water is sucked in by the solution given off from the tissue to the vessels. It was not possible to decide whether salts taken up from the medium are also transported with water. This process seemed independent of the osmotic value of the medium.

Rate of exudation, salt secretion and water conductivity of the roots were shown to suffer periodic fluctuations, a maximum occurring by day, a minimum during the night. A relation between the time at which maxima and minima occurred and certain conditions during the experiments or the period of cultivation could not be demonstrated.

The changes in the rate of exudation observed under certain conditions were in agreement with the supposition that the exudation consists of a transport of salt and a transport of water, the roots acting as an osmometer. A less satisfactory agreement between the osmotic value of the sap calculated according to this hypothesis and the value determined was sometimes found. In most cases too low a value was actually found, in some, however, the osmotic value of the exudation sap was higher than would be expected. The possible causes of this deviation have been discussed.

LITERATURE CITED

- ALBERDA, Th. 1948. The influence of some external factors on growth and phosphate uptake of maize plants of different salt conditions. *Rec. Trav. bot. néerl.* 41 : 541—601.
- ANDEL, O. M. VAN. 1952. Determinations of the osmotic value of exudation sap by means of the thermo-electric method of Baldes and Johnson. *Proc. Kon. Ned. Akad. Wet. Ser. C* 55 : 40—48.
- ANDEL, O. M. VAN, W. H. ARISZ and R. J. HELDER. 1950. Influence of light and sugar on growth and salt intake by maize. *Proc. Kon. Ned. Akad. Wet.* 53 : 159—71.
- ARISZ, W. H. 1945. Contribution to a theory on the absorption of salts by the plant and their transport in parenchymatous tissue. *Proc. Kon. Ned. Akad. Wet.* 48 : 420—46.
- ARISZ, W. H. 1947. Uptake and transport of chlorine by parenchymatic tissue of leaves of *Vallisneria spiralis*. II. Analysis of the transport of chlorine. *Proc. Kon. Ned. Akad. Wet.* 50 : 1233—45.
- ARISZ, W. H. 1948. Uptake and transport of chlorine by parenchymatic tissue of leaves of *Vallisneria spiralis*. III. Discussion of the transport and the uptake. Vacuole secretion theory. *Proc. Kon. Ned. Akad. Wet.* 51 : 25—33.
- ARISZ, W. H. 1952. Transport of organic compounds. *Ann. Rev. Plant Physiol.* 3 : 109—30.
- ARISZ, W. H. 1953. Active uptake, vacuole-secretion and plasmatic transport of chloride-ions in leaves of *Vallisneria spiralis*. *Acta Bot. Neerl.* 1 : 506—15.
- ARISZ, W. H. 1953. Absorption and transport by the tentacles of *Drosera capensis*. V. Influence on the transport of substances inhibiting enzymatic processes. *Acta Bot. Neerl.* 2 : 74—108.
- ARISZ, W. H., R. J. HELDER and R. VAN NIE. 1951. Analysis of the exudation process in tomato plants. *Jour. exp. Bot.* 3 : 257—97.
- ARNOLD, A. 1952. Ueber den Funktionsmechanismus der Endodermiszellen der Wurzeln. *Protoplasma* 41 : 189—211.
- BALDES, E. J. and A. F. JOHNSON. 1939. The thermo-electric osmometer; its construction and its use. *Biodynamica* 2 (47) : 1—11.