Study of nutrient distribution in the rose bush for foliar diagnostic purposes

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INTRODUCTION. — The mineral nutrition of the rose bush for cut flowers has been studied by many researchers. One of the least-known aspects of this subject is, perhaps, the nutrient distribution in the plant, a question that has rarely been dealt with. On this point the studies of CARLSON (1966), carried out on the variety « Better Times », deserve to be quoted. This author shows that the highest N contents are found in the upper leaves, followed in descending order by the lower leaves, buds and stems. The leaves always contain more N, Ca and Mg than the corresponding stems. On the contrary, in the case of K, the buds show the highest contents, followed by the leaves and, at a great distance, the stems.

JOHANSSON (1978) carries out a similar study on the variety « Parel van Aalsmeer » in which he makes particularly clear the effect of leaf position on the stem in the K concentration, which is higher in the terminal leaves; something similar occurs with Mg. These fluctuations in the concentrations of essential elements must be carefully borne in mind when taking the sample for foliar analysis.

With the aim of arriving at a better understanding of the nutrition of the rose bush we begin a series of studies on this matter in the crops of Tenerife (Canary Islands). In the present work the concentrations of nutrients in the different parts of the flowering stem have been determined, with a view to deciding which of these is most suitable a diagnostic tissue.

MATERIAL AND METHODS. — A sampling of the flowering stems in the cultivar GABRIELA was carried out during the month of January. Each sample was composed of 15 subsamples and every sample consisted of 4 repetitions. The flowering stems chosen were approximately 40 cms. long, which appears to be the most suitable length for the taking of samples in the foliar analysis of short-stemmed varieties. The stems were cut when the buds showed from five to three sepals open (a stage of development suitable for gathering for commercial purposes). The flowering stems were divided into the following parts: a) bud and peduncle, b) upper part of the stem to the second leaf, c) portion of the stem between the second and third leaves, d) portion of the stem between the third and fourth leaves, and so on. The different parts of the stem with their leaves, as also the bud and the peduncle were analysed separately.

It should be pointed out that the leaves which occupy the fourth and fifth positions on the stem are, in this case, the first two of 5 leaflets, always taken as samples for foliar analysis in our studies on the mineral nutrition of the rose (positions d and e in the graph).

The mineralization of the samples was carried out by the dry-ash method; the extraction was made by treating the ash with HCl 6 N. The determination of P was carried out in the extract by colorimetry according to the vanadate molybdate method, and the cations K, Ca, Mg, Fe, Mn, Zn and Co by atomic absorption spectrophotometry. The N was determined by the Kjeldahl method.

RESULTS AND DISCUSSION. — For greater clarity we shall set out separately the results relating to each nutrient. In graphs from n' 1 to n' 9 is shown the concentrations distribution of the mineral nutrients in the different parts of the flowering stem. Each point at the graphs represent the average of 4 repetitions.

Nitrogen. — The distribution of N in the different parts of the flowering stem is shown in graph No. 1. It can be seen, in the first place, that the greatest concentrations are found in the leaves, followed, at a great distance, by the buds, and the least in the peduncle and stems. The N concentration in the leaves does not vary appreciably with their position on the flowering stem. Due to this relative stability of the concentrations the situation of the leaves is not a critical factor as far as nitrogenous nutrition is concerned.

A gradual diminution of the concentrations in the stems is noted as we approach their basal parts.

Phosphorus. — The distribution of phosphorus according to the different organs is shown in graph No. 2. It can be seen that the greatest concentrations of this element are found in the bud, followed by the leaves, peduncle and stems, although, in fact, there are no great differences between the concentrations in the different parts of the flowering stem.

The P concentration in the leaves, as happens with N, does not appear to vary noticeably with their position on the flowering stem. A slight tendency of P to decrease as we pass to the lower parts of the stem, is noted.
**Potassium.** — The distribution of K in the different parts of the flowering stem is shown in graph No. 3. In this case the peduncle has the greatest concentrations, followed closely by the leaves and buds, which differ greatly from the stems where the minimal concentration is found.

**Calcium.** — The maximum calcium concentration is found in the leaves, followed, at some distance, by the peduncles, and stems, the buds showing the minimal value (graph No. 4). It is noted that the Ca concentration in the leaves decreases appreciably as they descend the flowering stem to leaf No. 4 (1" leaf of 5 leaflets), thereafter becoming stable. As regards the stems, a slight decrease of the Ca concentrations is noted as we approach the basal parts.

**Magnesium.** — The Mg concentrations show maximum value in the leaves, as can be seen in graph No. 5, followed by the stems, buds and peduncles. The foliar Mg concentrations undergo only small variations from leaf No. 3, so that any which occupy subsequent positions on the stem would be suitable for the diagnosis of magnesium.
nutrition (graph No. 5). The Mg concentrations in the stem show, in general, a slight tendency to decrease as we approach their basal parts, with a zone of maximum stability between the parts corresponding to leaves No. 4 and No. 5 (the first two leaves of 5 leaflets).

**Micronutrients.** — In the case of Fe it is also the leaves that show the maximum concentration, no appreciable differences being found between the stems, buds and peduncles (graph No. 6). The zone of maximum stability both for the leaves and the stems is found (as in the previous cases) between the leaves and stem parts No. 4 and No. 5 (first two of 5 leaflets).

The Mn concentrations in the leaves are much higher than those of the stems, buds and peduncles (graph No. 7). The concentration of this element in the leaves stabilize from leaf No. 2, no clear differences between the different stem parts being noticeable.

It should be pointed out here that we have noted a similar tendency in the distribution of the above-mentioned nutrients in the different parts of the flowering stem in our nutrient export studies on the cultivars «Mercedes», «Vista» and «Iona».

Cu and Zn (graphs No. 8 and 9) follow an inverse behaviour from that noted for Fe and Mn, since the maximum concentrations are found in the stems. These high Cu and Zn concentrations in the stems make them more suitable than the leaves for the diagnosis of nutrition in these elements. A similar tendency has been noted in the variety «Mercedes» (short stem), whereas the varieties «Vista» and «Iona» show similar Cu and Zn concentrations in leaves and stems.

**Conclusions.** — From the foregoing it can be deduced that although for some nutrients (such as N, K) the leaf position on the stem does not appear to affect the foliar concentrations greatly, in other cases (Ca, Mn, Cu) these concentrations vary widely according to leaf position.

In general, the greatest concentration variations are noted in the youngest leaves, the maximum stability being shown by the first two leaves of five leaflets (which, in this case, correspond to those occupying the 4th and 5th places on the flowering stem). The stability of the mineral nutrient concentration in these leaves makes them suitable as samples for diagnostic purposes; hence we have used them in our studies on the mineral nutrition of the rose bush for cut flowers.

**REFERENCES**


**SUMMARY.** — A study on the distribution of the mineral nutrients in the different parts of rose bush was carried out with the aim of choosing whichever of these might be most suitable as diagnostic tissue, the cultivar used being «Gabrielle».

Although for some nutrients (such as N, K) the leaf position on the stem does not seem to have a great effect on its foliar concentrations, in other cases (Ca, Mn, Cu) these concentrations vary widely according to the situation of the leaf. In general, the greatest concentration variations are noted in the youngest leaves, the maximum stability being shown by the first two leaves of 5 leaflets. This stability of the mineral nutrient concentrations in these first two leaves of 5 leaflets makes suitable as samples for diagnostic purposes.

**RESUMÉ.** — On a étudié la distribution des éléments nutritifs dans les différents parties des tiges florales du rosier pour fleur coupée, avec le propos de choisir la plus apte comme tissu de diagnostic. Le cultivar employé a été «Gabrielle».

Bien que pour quelques éléments nutritifs (par exemple, N, K) la position de la feuille sur le rameau ne paraît pas avoir aucun effet sur ces concentrations foliaires, dans d'autres cas (Ca, Mn, Cu) ces concentrations varient selon la situation de la feuille. En général, les plus grandes variations se trouvent dans les feuilles plus jeunes et la plus grande stabilité se trouve dans les deux premières feuilles à cinq feuilles. La stabilité des concentrations des éléments nutritifs dans les deux premières feuilles à cinq feuilles indique son aptitude comme échantillons pour l'analyse foliaire.

RESUMEN. — Se ha llevado a cabo un estudio de la distribución de nutrientes minerales en las diferentes partes del tallo floral del rosa para flor cortada con el fin de determinar cuál de ellas es la más idónea como tejido de diagnóstico. El cultivar utilizado fue «Gabriela».

Aunque para algunos nutrientes (tales como N, K) la posición de la hoja sobre el tallo no parece tener un gran efecto sobre sus concentraciones foliares, en otros casos (Ca, Mn, Cu) estas concentraciones varían ampliamente según la situación de la hoja. En general, las mayores variaciones de concentración se observan en las hojas más jóvenes y la máxima estabilidad se encuentra en las dos primeras hojas de cinco foliolos. Esta estabilidad de las concentraciones de nutrientes minerales en las dos primeras hojas de cinco foliolos las hace idóneas como muestras para el diagnóstico foliar.

RIASSUNTO. — Si è realizzato uno studio della distribuzione degli elementi nutritivi nelle differenti parti dello stelo della rosa da fiore reciso, allo scopo di scegliere quale di essi è più idoneo per la diagnosi. La cultivar utilizzata è stata «Gabriella».

Sebbene per alcuni elementi (come N, K) la posizione della foglia sullo stelo non sembri avere un grande effetto sulle concentrazioni foliarie, in altri casi (Ca, Mn, Cu) le loro concentrazioni variano amplamente, secondo la posizione della foglia. In generale le maggiori variazioni della concentrazione si osservano nelle foglie più giovani, e la massima stabilità si trova nelle prime due foglie (composte da 5 foglioline) e le rende idonee come campione per gli scopi di diagnosi foliare.

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Ad sorción de plaguicidas organofosforados por óxido grafitico

II. Fosdrin

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INTRODUCCIÓN. — La evolución de los plaguicidas aplicados al campo, que de forma directa o indirecta llegan al suelo, ha sido relacionada frecuentemente con el fenómeno de adsorción-desorción por las fracciones coloidales orgánica e inorgánica del suelo. Debido a ello son numerosas las investigaciones dirigidas al estudio de los mecanismos de adsorción de diferentes herbicidas e insecticidas por componentes tipo de dichas fracciones.

En el estudio de los mecanismos de adsorción de plaguicidas por la materia orgánica del suelo, varios investigadores han utilizado adsorbentes modelo tales como resinas de cambio iónico, nylon, triacetato de celulosa, etc. (Weed y Weber, 1974) a fin de obviar las dificultades encontradas en la aplicación de técnicas que permitan analizar los citados mecanismos.

La existencia en el óxido grafitico, al igual que en los ácidos húmicos, de grupos funcionales carbonilo, hidroxilo y epóxido, nos indujo a utilizar este material como modelo de adsorbente de plaguicidas organofosforados. Esta sustancia ha sido también utilizada como modelo de los ácidos húmicos en estudios de adsorción, solvatización, dispersión y coagulación de otros compuestos no plaguicidas (Thiele y Micke, 1950; Hamdi, 1952; Thiele y Andersen, 1953).

En un trabajo anterior mostramos nuestros resultados acerca de la interacción OG-diclororos, revelando la formación de dos compuestos interlaminares monocapa y bicapa respectivamente.

En el presente trabajo se extiende el estudio iniciado de la interacción OG/plaguicidas al fosdrin (1-metil 2-carbometoxivinil di-metil fosfato), molécula muy compleja, tanto por su tamaño molecular como por la presencia, en ella, de dos grupos funcionales activos, así como por la existencia de isómeros.
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JOHANSSON (1978) carries out a similar study on the variety « Parel van Aalsmeer » in which he makes particularly clear the effect of leaf position on the stem in the K concentration, which is higher in the terminal leaves; something similar occurs with Mg. These fluctuations in the concentrations of essential elements must be carefully borne in mind when taking the sample for foliar analysis.

With the aim of arriving at a better understanding of the nutrition of the rose bush we begin a series of studies on this matter in the crops of Teneriffe (Canary Islands). In the present work the concentrations of nutrients in the different parts of the flowering stem have been determined, with a view to deciding which of these is most suitable a diagnostic tissue.

MATERIAL AND METHODS. — A sampling of the flowering stems in the cultivar GABRIELLA was carried out during the month of January. Each sample was composed of 15 subsamples and every sample consisted of 4 repetitions. The flowering stems chosen were approximately 40 cms. long, which appears to be the most suitable length for the taking of samples in the foliar analysis of short-stemmed varieties. The stems were cut when the buds showed from five to three sepals open (a stage of development suitable for gathering for commercial purposes). The flowering stems were divided into the following parts: a) bud and peduncle, b) upper part of the stem to the second leaf, c) portion of the stem between the second and third leaves, d) portion of the stem between the third and fourth leaves, and so on. The different parts of the stem with their leaves, as also the bud and the peduncle were analysed separately.

It should be pointed out that the leaves which occupy the fourth and fifth positions on the stem are, in this case, the first two of 5 leaves, always taken as samples for foliar analysis in our studies on the mineral nutrition of the rose (positions A and E in the graph).

The mineralization of the samples was carried out by the dry-ash method; the extraction was made by treating the ash with HCl 6 N. The determination of P was carried out in the extract by colorimetry according to the vanadate molybdate method, and the cations K, Ca, Mg, Fe, Mn, Zn and Cu by atomic absorption spectrophotometry. The N was determined by the Kjeldahl method.

RESULTS AND DISCUSSION. — For greater clarity we shall set out separately the results relating to each nutrient. In graphs from n° 1 to n° 9 is shown the concentrations distribution of the mineral nutrients in the different parts of the flowering stem. Each point at the graphs represent the average of 4 repetitions.

Nitrogen. — The distribution of N in the different parts of the flowering stem is shown in graph No. 1. It can be seen, in the first place, that the greatest concentrations are found in the leaves, followed, at a great distance, by the buds, and the least in the peduncle and stems. The N concentration in the leaves does not vary appreciably with their position on the flowering stem. Due to this relative stability of the concentrations the situation of the leaves is not a critical factor as far as nitrogenous nutrition is concerned.

A gradual diminution of the concentrations in the stems is noted as we approach their basal parts.

Phosphorus. — The distribution of phosphorus according to the different organs is shown in graph No. 2. It can be seen that the greatest concentrations of this element are found in the bud, followed by the leaves, peduncle and stems, although, in fact, there are no great differences between the concentrations in the different parts of the flowering stem.

The P concentration in the leaves, as happens with N, does not appear to vary noticeably with their position on the flowering stem. A slight tendency of P to decrease as we pass to the lower parts of the stem, is noted.
The K percentage in the leaves undergoes little variation with their position on the flowering stem. With regard to the stem parts few differences are also noted, although the maximum concentration stability is found in the stem parts corresponding to the 4" and 5" leaves (1" and 2" leaves of 5 leaflets; positions d and e in the graphs).

Calcium. — The maximum calcium concentration is found in the leaves, followed, at some distance, by the peduncles, and stems, the buds showing the minimal value (graph No. 4).

It is noted that the Ca concentration in the leaves decreases appreciably as they descend the flowering stem to leaf No. 4 (1" leaf of 5 leaflets), thereafter becoming stable. As regards the stems, a slight decrease of the Ca concentrations is noted as we approach the basal parts.

Magnesium. — The Mg concentrations show maximum value in the leaves, as can be seen in graph No. 5, followed by the stems, buds and peduncles. The foliar Mg concentrations undergo only small variations from leaf No. 3, so that any which occupy subsequent positions on the stem would be suitable for the diagnosis of magnesium.

Potassium. — The distribution of K in the different parts of the flowering stem is shown in graph No. 3. In this case the peduncle has the greatest concentrations, followed closely by the leaves and buds, which differ greatly from the stems where the minimal concentration is found.
nutrient (graph No. 5). The Mg concentrations in the stem show, in general, a slight tendency to decrease as we approach their basal parts, with a zone of maximum stability between the parts corresponding to leaves No. 4 and No. 5 (the first two leaves of 5 leaflets).

**Micronutrients.** — In the case of Fe it is also the leaves that show the maximum concentration, no appreciable differences being found between the stems, buds and peduncles (graph No. 6). The zone of maximum stability both for the leaves and the stems is found (as in the previous cases) between the leaves and stem parts No. 4 and No. 5 (first two of 5 leaflets).

The Mn concentrations in the leaves are much higher than those of the stems, buds and peduncles (graph No. 7). The concentration of this element in the leaves stabilize from leaf No. 2, no clear differences between the different stem parts being noticeable.

It should be pointed out here that we have not noted a similar tendency in the distribution of the above-mentioned nutrients in the different parts of the flowering stem in our nutrient export studies on the cultivars «Mercedes», «Visà» and «Iona».

Cu and Zn (graphs No. 8 and 9) follow an inverse behavior from that noted for Fe and Mn, since the maximum concentrations are found in the stems. These high Cu and Zn concentrations in the stems make them more suitable than the leaves for the diagnosis of nutrition in these elements. A similar tendency has been noted in the variety «Mercedes» (short stem), whereas the varieties «Visà» and «Iona» show similar Cu and Zn concentrations in leaves and stems.

**Conclusions.** — From the foregoing it can be deduced that although for some nutrients (such as N, K) the leaf position on the stem does not appear to affect the foliar concentrations greatly, in other cases (Ca, Mn, Cu) these concentrations vary widely according to leaf position.

In general, the greatest concentration variations are noted in the youngest leaves, the maximum stability being shown by the first two leaves of five leaflets (which, in this case, correspond to those occupying the 4th and 5th places on the flowering stem). The stability of the mineral nutrient concentration in these leaves makes them suitable as samples for diagnostic purposes; hence we have used them in our studies on the mineral nutrition of the rose bush for cut flowers.

**References**


**Summary.** — A study on the distribution of the mineral nutrients in the different parts of rose bush was carried out with the aim of choosing whichever of these might be most suitable as diagnostic tissue, the cultivar used being «Gabriela».

Although for some nutrients (such as N, K) the leaf position on the stem does not seem to have a great effect on its foliar concentrations, in other cases (Ca, Mn, Cu) these concentrations vary widely according to the situation of the leaf. In general, the greatest concentration variations are noted in the youngest leaves, the maximum stability being shown by the first two leaves of 5 leaflets. This stability of the mineral nutrient concentrations in these first two leaves of 5 leaflets makes suitable as samples for diagnostic purposes.

**Résumé.** — On a étudié la distribution des éléments nutritifs dans les différents parts des tiges fleuris du rosier pour fleur coupée, avec le propos de choisir la plus apte comme tissu de diagnostic. Le cultivar employé a été «Gabrielle».

Bien que pour quelques éléments nutritifs (pour exemple, N, K) la position de la feuille sur le tige ne paraisse pas avoir aucune effet sur ces concentrations foliaires, dans autres cas (Ca, Mn, Cu) ces concentrations varient selon la situation de la feuille. En général, les plus grandes variations se trouvent dans les feuilles plus jeunes et la plus grande stabilité se trouve dans les deux premières feuilles à cinq feuilles. La stabilité des concentrations des éléments nutritifs dans les deux premières feuilles à cinq feuilles indique son aptitude comme échantillon pour l’analyse foliaire.

**Zusammenfassung.** — Man hat ein Studium über die Verteilung der mineralischen Nährstoffe in den verschiedenen Teilen des Blütenstockes der Rose durchgeführt, mit dem Erfolg, diejenigen auszuwählen, die am besten als diagnostisches Gewebe geeignet sind. Der dazu gewählte Anbau ist das Rosenblume «Gabrielle».

RESUMEN. — Se ha llevado a cabo un estudio de la distribución de nutrientes minerales en las diferentes partes del tallo floral del rosal para flor cortada con el fin de determinar cuál de ellas es la más idónea como tejido de diagnóstico. El cultivar utilizado fue «Gabriela».

Aunque para algunos nutrientes (tales como N, K) la posición de la hoja sobre el tallo no parece tener un gran efecto sobre sus concentraciones foliares, en otros casos (Ca, Mn, Cu) estas concentraciones varían ampliamente según la situación de la hoja. En general, las mayores variaciones de concentración se observan en las hojas más jóvenes y la máxima estabilidad se encuentra en las dos primeras hojas de cinco foliolas. Esta estabilidad de las concentraciones de nutrientes minerales en las dos primeras hojas de cinco foliolas las hace idóneas como muestras para el diagnóstico foliar.

RIASSUNTO. — Si è realizzato uno studio della distribuzione degli elementi nutritivi nelle differenti parti dello stelo della rosa da fiore reciso, allo scopo di scegliere quale di essi è più idoneo per la diagnosi. La cultivar utilizzata è stata «Gabriella».

Sebbene per alcuni elementi (come N, K) la posizione della foglia sullo stelo non sembri avere un grande effetto sulle concentrazioni fogliari, in altri casi (Ca, Mn, Cu) le loro concentrazioni variano ampiamente, secondo la posizione della foglia. In generale le maggiori variazioni della concentrazione si osservano nelle foglie più giovani, e la massima stabilità si trova nelle prime due foglie (composte da 5 foglioline) e le rende idonee come campione per gli scopi di diagnosi fogliare.

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Adsorción de plaguicidas organofosforados por óxido grafítico

II. Fosdrin

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INTRODUCCIÓN. — La evolución de los plaguicidas aplicados al campo, que de forma directa o indirecta llegan al suelo, ha sido relacionada frecuentemente con el fenómeno de adsorción-desorción por las fracciones coloidales orgánica e inorgánica del suelo. Debido a ello son numerosas las investigaciones dirigidas al estudio de los mecanismos de adsorción de diferentes herbicidas e insecticidas por componentes tipo de dichas fracciones.

En el estudio de los mecanismos de adsorción de plaguicidas por la materia orgánica del suelo, varios investigadores han utilizado adsorbentes modelo tales como resinas de cambio iónico, nylon, triacetato de celulosa, etc., (Weed y Weber, 1974) a fin de obviar las dificultades encontradas en la aplicación de técnicas que permitan analizar los citados mecanismos.

La existencia en el óxido grafítico, al igual que en los ácidos húmicos, de grupos funcionales carbonilo, hidroxilo y epóxido, nos indudó a utilizar este material como modelo de adsorbente de plaguicidas organofosforados. Esta sustancia ha sido también utilizada como modelo de los ácidos húmicos en estudios de adsorción, solvatación, dispersión y coagulación de otros compuestos no plaguicidas (Theile y Micke, 1990; Hamdi, 1992; Theile y Andersen, 1953).

En un trabajo anterior mostramos nuestros resultados acerca de la interacción OG-diclorvos, revelando la formación de dos compuestos interflamínares monocapa y bicapa respectivamente.

En el presente trabajo se extiende el estudio iniciado de la interacción OG/plaguicidas al fosdrin (1-metil 2-carbometoxivinil dimetil fosfato), molécula muy compleja, tanto por su tamaño molecular como por la presencia, en ella, de dos grupos funcionales activos, así como por la existencia de isómeros.