

Evaluation of *Plectranthus esculentus* N.E.Br. as a potential vegetable crop

by

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SUMMARY

The organography of the edible storage organs was studied both morphologically and anatomically, and possibilities for micro-propagation ascertained. Local occurrence of pests and diseases was monitored and the nutritional value of the edible storage organs determined. The effect of some environmental factors on the induction and development of storage organs was studied.

Both the morphological and anatomical studies proved that the edible storage organs produced by this species are true stem tubers, similar to those of the potato. Portions of these tubers are normally used to propagate the species, although rapid bulking of promising selections can be carried out by means of micro-propagation. Meristem culture techniques were very successful on standard MS basal salt medium to which $2.0\mu\text{M}$ CuSO_4 had been added. Once plantlets were large enough they were transferred to a rooting medium of vermiculite soaked in half-strength MS medium. If this step was omitted the survival rate after planting out was very low.

The use of cuttings to study tuberisation was investigated, and single-node cuttings from the

lower half of the stem gave the best results. Tuberisation on the cuttings reflected that on intact plants, with the induced state being best characterised by swelling of the bases of underground shoots. A scale of tuber development on cuttings during prolonged exposure to inductive conditions was developed. Leaf area played a role in yield determination and higher yields were obtained from cuttings with larger leaf areas.

Although temperature appeared to play a small role in tuber induction and growth in intact plants of *P. esculentus*, the major environmental factor influencing tuberisation appeared to be photoperiod. The critical photoperiod for tuber induction was between 12 and 13 hours, and an exposure period of four days to short photoperiods was sufficient to induce tuber formation. Low night temperatures did not influence tuber induction, although plant growth was reduced by night temperatures below 18°C.

Monitoring of plants in both field and glasshouse showed that very few pests and diseases attacked the species locally. Whitefly, red spider and fungus gnat were problematic in the glasshouse, but none appeared to cause significant problems to plants in the field. Root-knot nematodes were a problem, and were a contributing factor to a *Fusarium*-wilt outbreak. Charcoal rot (*Macrophomina phaseolina*) was the only other disease noted. Resistant selections should be sought in order to limit damage caused by these diseases, and suitable fungicides and cultural practices to control these diseases should be tested.

The tubers are a good source of carbohydrates, making the plant suitable as a staple, as well as providing appreciable amounts of protein, vitamin A, Ca, Fe and other compounds to the diet. Studies indicated that it is more valuable from a nutritional point of view than potato and sweet potato.

Although this study has contributed greatly to the existing knowledge of this minor crop, a great deal of research regarding the physiology and cultivation of the crop still needs to be done.

Evaluasie van *Plectranthus esculentus* N.E.Br.

as 'n moontlike groetegewas

deur

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OPSOMMING

Die organografie van die eetbare ondergrondse stoororgane is beide morfologies en anatomies ondersoek, en die moontlikheid van weefselkultuur vermeerdering bepaal. Plaaslike peste en plaë is waargeneem en die voedingswaarde van die stoororgane bepaal. Die effek van sommige omgewingsfaktore op die induksie en ontwikkeling van die stoororgane is ondersoek.

Beide die morfologies en anatomiese studies het bewys dat die eetbare stoororgane van hierdie plant ware stingelknolle is, soortgelyk an die van die aartappel. Normaalweg word gedeeltes van die knolle gebruik om die volgende jaar se gewas te plant, maar weefselkultuur kan massaproduksie van belowende seleksies versnel, en bied ook moontlikhede vir die langtermyn bewaring van genotipes. Die kweek van groeipunte op standaard MS-medium met bygevoegde $2.0\mu\text{M}$ CuSO_4 was baie suksesvol. 'n Bewortelingsmedium, van vermikuliet benat met halfsterkte MS-medium het goeie resultate met die beworteling van plantjies gelewer.

Die gebruik van steggies om knolvorming te bestudeer is ondersoek, en enkelnode steggies

van die onderste helfde van die stingel het die beste resultate gelever. Knolgroei op die steggies was vergelykbaar met die op intakte plante. 'n Skaal van knolontwikkeling op steggies, soos beïnvloed deur toenemende blootstelling aan induserende toestande, is ontwikkel. Blaaroppervlakte het 'n rol gespeel in die bepaling van knolmasse, en die hoogste opbrengste is behaal op steggies met die grootste blaaroppervlak.

Alhoewel temperatuur 'n betreklike klein rol speel in knolinduksie en groei van *P. esculentus* plante, is daglengte die belangrikste omgewingsfaktor wat knolinduksie betref. Die kritiese daglengte vir knolinduksie is tussen 12 en 13 uur, en 'n vier dae blootstellingsperiode aan kortdae is voldoende om knolvorming te inisieer. Lae nagtemperatuur affekteer nie knolvorming nie, maar plantgroei word wel benadeel by nagtemperatuur benede 18°C.

Min peste en plae het op die plante voorgekom, beide in die glashuis en op die landerye. Witvlieg, rooispinmyt en swammuggies het probleme in die glashuis veroorsaak, maar nie in landerye nie. Knopwortel-aalwurm (*Meloidogyne* spp.) was 'n probleem in die lande, en was 'n bydraende faktor in *Fusarium*-verwelk wat in sommige veldaanplantings voorgekom het. Swamdoders, en verbouingspraktyke behoort ondersoek te word om hierdie siekte te beheer. Swartverrotting weens *Macrophomina phaseolina* was die enigste ander siekte wat opgemerk is.

Die knolle is 'n goeie bron van koolhidrate, wat dit geskik maak vir gebruik as 'n stapelvoedsel. Dit lewer ook noemenswaardige hoeveelhede proteïene, vitamien A, Ca, Fe en ander belangrike minerale. Uit 'n voedingsoogpunt blyk dit meer waardevol te wees as vergelykbare eksotiese spesies soos aartappel of patat.

Alhoewel die studie baie bygedra het tot die kennis van hierdie minder bekende gewas, is baie navorsing oor die fisiologie en verbouingspraktyke nog nodig.

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