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ARC-Vegetable and Ornamental Plants Newsletter

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Newsletter of Vegetable and Ornamental Plants, a campus in the Crop Sciences Programme of the Agricultural Research Council (ARC)

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Inside this issue:

Welcome to the ARC-VOP newsletter: A newsletter on our activities and research

The Agricultural Research Council-Vegetable and Ornamental Plants (ARC-VOP) conducts innovative, need-driven, environment friendly research, technology development and technology transfer on vegetables (including African/indigenous vegetables, potatoes, sweet potatoes), indigenous flowers and medicinal plants.

The ARC-VOP established a proud record of innovative research and service delivery to the agricultural industry. The campus makes a significant contribution to small-holder farmer development in the country. Research involves a variety of disciplines including crop science, crop protection, breeding, genetics, biotechnology, agro-processing and post-harvest technology.

Our aim is to improve the productivity, competitiveness and sustainable production of vegetables, medicinal- and ornamental plants. A wide range of national, regional and international collaborators and partners are involved in the research programmes of the ARC and capacity development for the sector is demonstrated through the high number of students involved in research projects. Research impacts on the alleviation of poverty, enhances food and nutrition security through broadening the food base and production systems development for improved productivity.

The ARC-VOP newsletter was established in May 2018 to report on various activities from the ARC-VOP campus relevant to the public and our stakeholders. The activities will include research, awards, upcoming events and technology transfer events.

The newsletter will be published quarterly on the ARC website (www.arc.agric.za). Looking forward in sharing some exciting developments in our next issue of this newsletter.

Senior Manager: Vegetables
Dr Sonja Venter

For any enquiries regarding the newsletter, please contact: ***Ms Tsholo Tselapedi at TselapediT@arc.agric.za***

Entrance to the reception of ARC-Vegetable and Ornamental Plants at Roodeplaat campus, KwaMhlanga Road, Pretoria.

GROW NUTRITIOUS LEAFY VEGETABLES IN AN OLD MAIZE-MEAL BAG

Compiled by Dr Martin Maboko and Mr Silence Chiloane, Crop Science Division

The Crop Science Division, Agricultural Research Council–Vegetable and Ornamental Plants is conducting research trials on container gardening to optimise production of leafy vegetables with the aim of addressing food security. Availability of good soil and land for household vegetable production is becoming a major constraint. However, there is an alternative way of growing vegetables and to optimise yield per unit area for household production. Plants grown in bag system are growing vertically upwards which results in efficient use of space/ land. The bag system can be used in places that have not previously been thought of as appropriate for food gardens, such as small gardens, paved land and balconies. The bag is able to hold water for a longer time, without water and nutrients draining away into the soil. Plant leaves are not in contact with the soil resulting in less effort to clean the leaves before marketing or consumption. In order to plant vegetables in a bag system, the following are required: empty maize-meal bag (80, 50 or 25 kg bag), soluble fertiliser, growing medium (compost, sawdust or soil with good drainage), watering-can and seedlings.

Steps to follow:

- Moisten the growing medium with water to allow good distribution of water during irrigation
- Fill a maize-meal bag with the moistened growing medium such as sawdust or compost
- Use a sharp blade to cut openings in the bag at a distance 20 cm x 10 cm for planting holes
- Transplant seedlings of leafy vegetables such as kale, rape, mustard spinach, Swiss chard, spinach, beetroot and lettuce
- Push the seedling root plug into the planting hole in the maize -meal bag
- In an 80 kg of maize meal bag you can plant on average up to 56 plants
- Make sure that the bag is upright to allow the uniform distribution of water
- Make sure that the growing medium doesn't dry-out and water the plants from the top of the bag and the water will drain downwards to benefit the lower plants
- Complete nutrient solution can be applied on a weekly basis to supply plants with nutrition. Dissolve 1 gram per litre of water of soluble fertiliser for each of the following fertilisers, Multifeed and Calcium Nitrate
- Plants can be watered every second day (e.g. in 80 kg bag 60 -90 L water can be applied per week)
- Plants should be exposed to the sunlight for the process of photosynthesis to take place.

Leafy lettuce growing in a bag system.

Mustard spinach harvested from a bag system.

Advantages of the bag system:

- It conserves water since there is a little amount of water draining out of the bag
- It suppresses weeds, no weed control is needed
- Plant leaves are free from soil particles since plants leaves faced upwards and have contact with the soil
- There is high yield per unit area, compared to growing on a flat area
- Requires less area to produce food (56 plants/m^2).

Disadvantages:

- Poor drainage medium can have a negative effect on moisture distribution and root aeration
- Bags need to be supported and kept upright for uniform distribution of water
- Maize-meal bag cannot be reused, with time it can be torn apart and disintegrate, depending on how strong the bag is.

Seedlings of leafy vegetables being transplanted in a bag system.

Swiss chard 'spinach' growing in a bag

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ALL YOU NEED TO KNOW ABOUT INTERCROPPING

Compiled by Mr Buhlebelive Mndzebele, Crop Sciences Division

The Crop Science Division, Agricultural Research Council–Vegetable and Ornamental Plants is conducting research on various cropping systems to recommend and improve food and nutritional security in smallholder farmers. The greatest concern that has led to this research is the fact that there are limited resources such as land, water and fertilisers, especially in rural communities. These cropping systems are studied as a solution to enhance resource utilisation and eventually improve livelihoods in smallholder household production. One of the commonly practiced cropping systems is intercropping.

Intercropping is an old cropping practice which involves growing or cultivation of two or more crops in the same field in a season. These crops could be planted at the same time or alternated depending on the purpose. Intercropping is normally practiced in places where there is low mechanised agriculture dominated by subsistence agriculture. Therefore, intercropping potentially contributes to higher yields, assures crop success to meet food demand, improve soil quality and income. Therefore intercropping has advantages.

ADVANTAGES OF INTERCROPPING

Intercropping has numerous advantages particularly in terms of yield relative to mono cropping, and this ensures efficiency in terms of water, nutrients, solar radiation and land.

LAND: Intercropping becomes important for smallholder farming because of possible crop failure. Intercropping ensures yield increase when two crops are grown together as compared to mono-cropping.

WATER: More water has been reported to be conserved in intercropping due to high leaf area. In addition, there is reduced water losses as a result of intercropping. Intercropping has a better water use efficiency than single crops or mono-cropping.

SOLAR RADIATION: Intercropping is known to increase solar radiation utilisation and this depends on the elevation of the sun particularly visible in row intercropping. Normally there is improved crop production, hence more yield in intercrops due to efficient utilisation of solar energy.

NUTRITION: The process of N_2 fixation enables the availability of atmospheric N to be accessible to plants for uptake. Several studies have shown more N content in non-leguminous crops as a result of intercropping with legumes. Legumes may transfer part of symbiotically fixed N to the intercropped cereal.

Mono-cropping of amaranth.

TYPES OF INTERCROPPING

There are four groups and these include mixed, strip, relay and row intercropping.

- Mixed-intercropping entails growing a minimum of two crops together in no particular order. This is mainly suitable for pasture where grass and legumes have been planted
- Strip-intercropping involves growing of two or more crops in various strips simultaneously in a considerable distance from each other
- Relay-intercropping: crops grow together, however the second one is introduced when the first has reached reproductive stage, just before harvesting
- Row-intercropping: the companion crops are planted in regular rows, and these could be grown together or in relation to the first crop.

A study was done at ARC-Roodeplaat on the intercropping of amaranth and cowpea. Results showed that it was beneficial to do intercropping as opposed to mono-cropping. Our study showed that space was saved when you amaranth and cowpea are planted together. There was less fertiliser that was needed for crop production and growth due to the legume. In general, intercropping contributed to higher yields, assured crop success to meet food demand, improve soil quality and therefore more income.

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Intercropping of amaranth and cowpea at Roodeplaat, Pretoria.

Mono-cropping of cowpea.

Mycoflora diversity on traditional medicinal plant products

Compiled by Dr Mariette Truter, Crop Protection Division, Dr Ashwell Ndhlala and Dr Dambudzo Penduka, Crop Sciences Division

Traditional medicinal plants have a long history of use as a important alternative therapy in South Africa and it has been reported that around 80% of South Africans regularly use traditional medicines (Street & Prinsloo, 2013). Mai Mai and Marabastad are known to be the largest traditional medicinal plant trade markets in Gauteng, South Africa. As with any organic product, problems with quality can arise if the methods of harvesting, transporting, storing and distribution of medicinal plants are not supporting the proper preservation of the products (Katerere *et al*. 2008). It is therefore important to establish which fungi are associated with herbal medicines sold at markets. The aim of this study was to investigate the mycoflora associated with selected medicinal plant material commonly sold at two Muthi markets in Gauteng as well as those cultivated at Roodeplaat, Pretoria.

Five medicinal plants, namely *Aloe* sp., *Artemisia* sp., *Hypoxis* sp., *Moringa* sp. and *Siphonochilus* sp., were selected and purchased from Mai Mai, Johannesburg and Marabastad, Pretoria traditional medicine markets. Cultivated plants from the same taxon were collected from Roodeplaat, Pretoria and air dried. All collected plant material were finely grounded in order to obtain a uniform sample. Small amounts of the grinded plant material were plated to two fungal growth media, namely Malt Extract Agar (MEA) and Selective Fusarium Agar (SFA). After incubation of the growth media for a week, fungal isolates were selected and transferred to various growth media for morphological identification based on colony characteristics such as colour, texture, and growth rate, and microscopic characteristics. Molecular identifications were based on nBLAST analysis of DNA sequences of selected gene regions (ITS, RPB2, TEF and/or BT).

Fungal colonies were retrieved from all the samples that were obtained from both markets, but not from the *Aloe* and *Moringa* samples collected from Roodeplaat. For Mai Mai market a total of 93 fungal isolates were obtained, for Marabastad 49 isolates and for Roodeplaat only 16 isolates. Although the number of fungal isolates differ between the sampling source and between the plant types, the same type of fungal genera were found on samples from all the localities. Commonly retrieved fungal genera included *Aspergillus*, *Fusarium*, *Mucor*, *Penicillium*, *Rhizomucor*, and *Rhizopus* spp.

The current results showed that traditional medicinal plant material commonly sold at Muthi markets as well as those cultivated at Roodeplaat, Pretoria have a variety of fungal genera associated with the dried products. Further studies are underway to evaluate

One of the Muthi stalls in Gauteng from which medicinal plant products were bought.

more medicinal plant product samples for mycoflora diversity and abundance, as well as to investigate possible sources of the origin of the fungi on these samples. Comparing different post-harvest handling and storage conditions of medicinal plant products, will contribute to our understanding of the quality and shelf life of these products. Continued research is required as currently no conclusions can be made about natural fungal diversity on these plant products or if any of the plant materials were exposed to mycoflora contamination during the processing stage.

References:

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Street, R.A., Prinsloo, G. 2013. Commercially important medicinal plants of South Africa: A review. Journal of Chemistry 2013, article ID 205048, 16 pages.

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Siphonochilus sp.

Hypoxis sp.

Artemisia sp.

Aloe sp.

Moringa sp.

Greenhouse millipedes damaging vegetables in Gauteng

Compiled by Dr Diedrich Visser, Crop Protection Division

Reports of small millipedes damaging vegetables were received during April 2018, from a farm in the Heidelberg area of Gauteng. The crops affected were all grown in greenhouse tunnels and included parsley, celery and sweet peppers. When the affected plants were uprooted, large numbers of these small millipedes were observed crawling from the root area of the plants (Fig 1). Of the three crops, it was mainly the parsley plants that showed wilting symptoms. The extent of the damage seemed patchy; not all plants in the greenhouse were affected.

The millipede was identified as the greenhouse millipede, *Oxidus gracilis*, an introduced species, presumably from Japan. Today it occurs globally and is common in leaf litter in most gardens. Greenhouse millipedes are primitive members of the Class Diplopoda (Order Polydesmida; Family Paradoxosomatidae). Members of this order are sometimes referred to as "keeled millipedes" because of prominent lateral extensions ("keels" or ridges) of the body rings (Fig 2). These keels cover the bases of the legs and give the millipede a flat rather than cylindrical appearance when viewed from above. They can therefore be confused with small centipedes. However, unlike centipedes they have no eyes, and can roll into a tight ball when disturbed (Fig 3). All keeled millipedes are smallish is size (4-25 mm in length), with no more than 20 body segments (less than 32 pairs of legs). They are therefore easily distinguishable from the common cylindrical millipedes (Fig 4).

Like all millipedes, greenhouse millipedes live mostly in moist conditions and on dead vegetable and other decomposing organic matter. They therefore play an important role in soil ecology by breaking down litter into soil nutrients. However, because of their opportunistic behaviour, some millipedes may consume living plants on occasion, especially when their numbers increase to extraordinary high numbers. This is often the case in greenhouses where soils are kept moist and where the protected environment provides ideal conditions for rapid growth. Although one female can lay up to 300 eggs, it takes more than two months to reach the adult stage. Control must therefore only be considered in exceptional cases. By limiting favourable conditions, e.g. high humidity and soils high in organic material, the incidence of the greenhouse millipede may be reduced. Pesticides for millipede control on "various crops", are available (www.croplife.co.za).

Although known as a world-wide greenhouse pest, the exact nature of the damage by greenhouse millipedes, and the potential yield losses to crops in South Africa, are unclear. We suspect that the limited damage observed with parsley plants were due to disturbances in the rhizosphere, and maybe limited feeding on tender roots.

Fig. 1. The Greenhouse millipedes that were found between roots of certain vegetable plants in Gauteng.

Fig. 2. Adult greenhouse millipedes typically have 20 body segments with lateral ridges on most segments. This individual is mature and 20 mm in length. .

Fig. 3. The greenhouse millipede also roll into a tight ball when disturbed.

To be able to investigate this phenomenon further, we request farmers who encounter any keeled millipede on their crops to contact ***Diedrich Visser at dvisser@arc.agric.za***.

Acknowledgments: Ettienne Grundling of Laeveld Agrochem and Bill Kerr of Alpha Seed for providing information on the occurrence of the greenhouse millipede in Gauteng, and Prof Michelle Hamer of SANBI, for kindly identifying the millipedes.

Fig. 4. The common millipedes (songololos) in the order Spirostreptida are easily distinguishable from the keeled millipedes (Order Polydesmida).

Technology Transfer

Scientific publications

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Ntila, S., Ndhlala, A.R., Kolanisi, U., Abdelgadir, H., Siwela, M., 2018. Acceptability of a moringa-added complementary soft porridge to caregivers in Hammanskraal, Gauteng province and Lebowakgomo, Limpopo province, South Africa. *South African Journal of Clinical Nutrition* 1(1): 1-7.

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Book chapter

Mpandeli, S., Nesamvuni, AE. Maponya, P. 2018. Soil Ecology and Land – Use Management. Adapting to the Impacts of Drought by smallholder farmers in Sekhukhune District, Limpopo Province, *White Word Publications*, USA, ISBN 978-12-97892878 -7, Chapter 16, pp.155-164.

Training courses:

The Agricultural Research Council – Vegetable and Ornamental Plants, Roodeplaat is offering an accredited hydroponic vegetable production training course. For more information, contact Ms Tsholo Tselapedi: (012) 808 8000 or TselapediT@arc.agric.za

Look out for our next issue of the ARC-VOP newsletter covering events from April to June 2018 that will be published on the ARC website (www.arc.agric.za)!