

## O.42 - Essential oil and plant extracts as potential substitutes to synthetic fungicides in the control of fungi

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### Abstract

Maize is one of the most important cereal crops in the world. It provides stable food to many populations. In the developing countries maize is a major source of income to farmers among whom many are resource-poor farmers. Maize cultivation is limited by diseases which cause grain loss of about 11% of the total production. The control of maize diseases is very important as a complementary technology to boost maize production. Various approaches have been used over many decades to control maize diseases. These include breeding for resistance, chemical treatment including seed treatment and biological control. The limits of these approaches have prompted the need of other alternatives method to control diseases of maize. To this effect the use of essential oil extracted from 3 aromatic plants have been investigated for the control of seed-borne fungi infecting maize seeds. These are *Cymbopogon citratus*, *Occimum gratissimum* and *Thymus vulgaris*. Bioassays using poisoning technique have been used with *Fusarium verticilloides* as reference fungi. The results disclosed the fungicidal properties of these oils. These natural products control the seed-borne inoculum of *Fusarium verticilloides* from 90% to 100%. Other fungi infecting maize seeds were also controlled. Crude powder of the plants was also investigated and proved an efficient control of fungi in seeds during laboratory and field tests. Fields trial conducted in the humid forest and the warm savannah zones of Cameroon have shown that these products are potential seed treatments which could be used as substitutes to synthetic fungicides which are usually unaffordable to resource limited farmers.

### Introduction

Maize is an important cereal crops in the world. It provides staple food to many populations. In developing countries maize is a major source of income to farmers among whom many are resource-poor. Maize cultivation in the world is limited by diseases which cause grain loss of about 11% of the total production. The control of maize diseases is very important as a complementary technology to boost maize production. Various approaches have been used over many decades to control maize diseases. These include breeding for resistance, chemical treatment including seed treatment and biological control. The limits of these approaches have prompted the need of other alternatives method to control diseases of maize. To this effect the use of essential oil extracted from three aromatic plants have been investigated for the control of seed-borne fungi infecting maize seeds.

### Materials and methodology

The essential oil was extracted from three plants, *Cymbopogon citratus*, *Occimum gratissimum* and *Thymus vulgaris*. The extraction method was hydrodistillation using the Clevenger apparatus. Bioassays were carried out using the poisoning technique of Groover and Moore (1992). The reference fungus was *Fusarium verticilloides* isolated from maize seeds and stored on PDA media. The essential oil was emulsified in agar 1%. The treatment was performed by mixing the seeds and the agar solution. Treating seeds with synthetic fungicides and crude powder was performed by dusting. Testing of treated and untreated seeds for fungi was carried out using the blotter method of Sing *et al.* (1974).

In the field the planting was 3 seeds per hill at a distance of 50cm between the hills and 75cm between the rows. This equates to a density of 53333 plants per ha.

## Results

### Fungicidal properties

The results of the bioassays showed that the essential oils reduced the radial growth of *Fusarium verticilloides* and disclosed fungicidal properties at 200ppm and 500ppm respectively for *O.gratissimum*, *C. citratus* and *T. vulgaris*.

This result was similar to that of Mishra and Dubey (1994) who evaluated some essential oils for their toxicity against fungi causing deterioration of stored food commodities.

### Control of seed-borne fungi

The three essentials controlled 90 to 92% infections of *Fusarium verticilloides* and other fungi in the treated seeds (Table1). This level of control was similar to that of Benlate which achieved 99% control of the infection.

Table 1: Control of seed-borne fungi in treated seeds.

Treatment	Benlate	<i>C.citratus</i>	<i>O.gratissimum</i>	<i>T. vulgaris</i>	Non treated
Dosage/concentration.	0.1%w/w	2%	6%	5%	0%
Control of seed-borne fungi	99%	90%	91%	92%	0%

### Improvement of germination

The germination of treated seed shows important improvements between the treated seed and the untreated control. The germination of the seeds treated with the essential oil was similar to that of the seeds treated with the synthetic fungicide Benlate.

Table 2: Improvements in the germination of treated seeds.

Treatment	Benlate	<i>C.citratus</i>	<i>O.gratissimum</i>	<i>T. vulgaris</i>	Non treated
Dosage/concentration.	0.1%w/w	2%	6%	5%	0%
Germination	94%	93	93	91	88%

### Improvement of seedling vigour and root mass

During the evaluation of seedlings to determine normal seedlings/abnormal seedlings it was noted that those from the treated seeds with essential oil were more vigorous. Additionally these seedlings disclosed higher root mass compared to the non-treated and those treated with Benlate.

### Plant improvement in the field

In field tests conducted in the humid forest and the warm savannah zones of Cameroon, plant densities were highly increased in the plot treated with essential oil. Similar observations were found in the plots treated with crude powder of the 3 aromatic plants as well as the Benlate.

## Conclusion

It was concluded after these investigations that essential oils and crude powder from aromatic plants are potential treatments for the control of seed-borne fungi. This research places the oil extracted from the 3 aromatic plants in the pipeline of new product development for the control of fungi. The crude powders are potential products which could rightly serve as substitutes of synthetic fungicides whose cost is usually unaffordable to resource-limited farmers.

## References

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