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Short Communication

Influence of *Moringa oleifera* Leaf Extracts on Germination and Seedling Survival of Three Common Legumes

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ABSTRACT

Influence of Moringa (*Moringa oleifera*) leaf extracts on germination and seedling survival of three popularly consumed legumes; beans (*Phaseolus vulgaris* L.), groundnut (*Arachis hypogea* L.) and cowpea (*Vigna unguiculata* (L.) Walp.) was investigated. Extracts from Moringa leaves forced beans to germinate early and increased duration to first germination by 100%. Extract from Moringa increased germination percentage of cowpea by 4%, while reduced germination of groundnut seed by 4%. Moringa extract lowered seedling survival by 3.7% each of beans and cowpea and 10% in groundnut. Moringa extract increased radical length by 4% in beans, but reduced radicle length of cowpea by 24% and by 21% in groundnut. These extracts increased hypocotyl length by 16.6% in groundnut, but reduced hypocotyl length by 14% in cowpea, while it did not affect hypocotyl length in beans. Moringa extract reduced development of seed hypocotyls by 4% in beans, 4.4% in cowpea and 66.6% in groundnut. Application of Moringa leaf extracts to legume seeds will delay crop emergence and reduce root length and field survival of legume crops. © 2010 Friends Science Publishers

Key Words: Beans; Cowpea; Germination; Groundnut; Hypocotyl; Moringa; Radicle

INTRODUCTION

Morinda (*Moringa oleifera L.*) has been reported to provide human, livestock and crop nutritional benefits (Fuglie, 2001). Other useful plants such as eucalyptus have been reported to produce allelopathic compounds known as phytotoxins during decomposition that inhibit or retard germination, growth and development of some crops (Wicks *et al*., 1994; Chung & Miller, 1995; Cheema *et al.,* 2000; Jabran *et al.,* 2009). Some investigators (Farooq *et al*., 2008) have reported allollepathic effects of crops such as rice on seedling development in wheat. Moringa which is being promoted in Zambia has been reported to increase crop growth and yield (Foidl *et al.*, 2001). Moringa accelerates growth of young plants, strengthens plants, improves resistance to pests and diseases, prolongs life-span, increases number of roots, stems and leaves, produces more and larger fruits and generally increases yield by around 20-35% (Fuglie, 2001). These findings have been supported by Price (1985), who reported an increase in growth and yield of crops due to use of Moringa. Moringa has also been reported to significantly improve soil fertility if used as a green manure (Davis, 2000), when Moringa seedlings are ploughed into the soil to a depth of 15 cm at the age of 25 days. Price (1985) reported that improvements in crop growth and yield results from the influence of Zeatin: a plant growth hormone from the Cytokinines group.

Moringa is increasingly becoming popular among communities in Zambia for uses such as a food supplement, as a weaning food in children and for medicinal purposes. Stakeholders such as the health sector are promoting Moringa as a food supplement, while others such as the water sector are promoting Moringa for water treatment. The use of Moringa for agricultural purposes to enhance seed germination, growth and yield of crops has not been tested in Zambia. In the wake of increasing global prices of inorganic fertilizer, land and water pollution arising from use of inorganic fertilizer and the contribution of inorganic fertilizer to climate change, there is a need to investigate the effect of *M. oleifera* on seed germination, growth and yield of crops so that it can be promoted as a multipurpose plant among farmers. The objective of this study was to investigate the effect of *M. oleifera* leaf extract on germination and seedling survival of common legumes.

MATERIALS AND METHODS

Extracts from fresh leaves were used to test the effect of *M. oleifera* plant extracts on germination and seedling survival of beans (*Phaseolus vulgaris* L.), cowpea (*Vigna unguiculata* (L) Walp.) and groundnut (*Arachis hypogea* L.). Aqueous extract of Moringa at the ratio of 1:10 (w/v) was prepared by mixing 30 g of plant leaf material with 300 mL of distilled water in a household blender for 15 min. The solution was filtered through filter paper (Whatman No. 42). Petri dishes were sterilized for 1 h 30 min in an autoclave. Ten seeds of beans and similar quantities of cowpea and groundnut were placed at the bottom in separate petri dishes

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and covered with filter paper (Whatman No. 2). Moringa extract (15 mL) was added to each of the petri-dishes. Distilled water was used as a control. Petri dishes were incubated in a lit room at an average temperature of about 25°C for 14 days. The treatments were arranged in a completely randomized design with three replicates. Measurements recorded were germination percentage, developed hypocotyls, radicle and hypocotyl length and seedling survival. Data were analyzed following analysis of variance (SAS, 1985) procedure. Means were separated by Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

The duration to first germination was increased ($p<0.001$) by about 100% in beans (2 days from one day observed in the control), while it did not affect this duration in cowpea and groundnut. In both beans and groundnut, first germination was recorded within 24 h after planting. Moringa leaf extract increased germination percentage of cowpea by about 4% from 76.7% in the control to 80% in the treated seeds. However application of Moringa leaf extracts reduced germination percentage of groundnut from 70% in the control to 66.7% in the treated seeds. Application of Moringa leaf extracts across all legume seeds reduced seedling survival by varying magnitudes. The seedlings were alive and healthy for 5 days after which they started dying. The highest seedling mortality (10.0%), from 66.7% in the control to 56.7% in the treated seeds, was observed in groundnut followed by 3.7% in both beans and cowpea (Table I).

Extracts from fresh leaves of *M. oleifera* contained substances with inhibitory effect on germination of groundnut and survival of beans and cowpea seedlings. It is likely that inhibitory substances found in the groundnut (Zakaria & Razak, 1990) could have reacted with substances in Moringa, which appeared to reduce germination percentage and seedling survival of groundnut. The differences in the germination percentage and seedling survival among seeds of groundnut, cowpea and beans could be attributed to differences in the selective permeability of the seed coat to the inhibitory substances (Zakaria & Razak, 1990) and higher sensitivity of groundnut compared to beans and cowpea.

Application of Moringa leaf extracts significantly ($p<0.001$) impaired the production of hypocotyls in beans and groundnut. The highest failure rate to form hypocotyls was 66.6% recorded in groundnut, where only 16.7% of the groundnut seed applied with Moringa leaf extracts produced hypocotyls. About 50.0% of the groundnut seeds in the control formed hypocotyls. In beans, 76.7% of the seed in the control produced hypocotyls, while only 73.3% of the seed treated with Moringa leaf extracts produced hycotyls (Table I).

Application of Moringa leaf extracts reduced development of hypocotyls in legumes. In beans, application of Moringa leaf extracts reduced development of hypocotyls by 14.3% (0.3 cm) from 2.1 cm in the control to 1.8 cm in seeds treated with Moringa. In groundnut, application of Moringa leaf extracts reduced development of hypocotyls by about 20.0% (0.3 cm) from 1.5 cm in the control to 1.2 cm in treated seeds, while it had no effect on development of hypocotyls in cowpea. The results show that early contact of Moringa extract with seeds of cowpea and groundnut impairs formation and development of hypocotyls, which develops into a shoot system. The results of impaired formation of hypocotyls and reduced hypocotyl lengths caused by application of Moringa leaf extracts obtained in this experiment have negative implications of delayed field emergence and poor establishment of crops (Sheppard & Floate, 1984), which would reduce field establishment of beans and groundnut. These findings are in agreement with those of Knittle and Burris (1979) of high correlation between hypocotyl length with rapidity of emergence in Soybean.

Application of Moringa leaf extracts to cowpea significantly ($p\geq0.001$) reduced radicle length by 23.5% (1.6 cm) from 6.8 cm in the control to 5.2 cm in cowpea seed treated with Moringa leaf extracts. In groundnut application of Moringa leaf extracts reduced radicle length by 14.0% (0.8 cm) from 5.7cm in control to 4.9 cm in seeds treated with Moringa extracts. However Moringa leaf extracts increased radicle length of beans by 0.3cm (4.3%) from 7.0 cm in the control to 7.3 cm in bean seeds treated with Moringa leaf extracts (Table I). The results of reduced radicle length are not consistent with results reported by Foidl *et al.* (2001) on improved crop performance when applied with Moringa leaf extracts. The variations in the results obtained could be attributed to the direct contact between seed and Moringa leaf extracts, which could have led to poor germination and impaired development of hypocotyls and radicles in the legumes in this study. Moringa seems to have substances, which impede germination, formation of hypocotyls and radicle development, which were not isolated in this study. The results further indicate that early contact of Moringa leaf extract with seeds impairs formation and development of radicle of cowpea and groundnut. The impaired formation and development of radicle is likely to negatively affect root length and field survival of cowpea and groundnut. These results are in agreement with the findings of Balsberg-Påhlsson (1995) who reported that reduced radicle length had negative implications of reducing root length of crops, which was crucial for field survival of soya beans. However further research is needed in this area.

CONCLUSION

Addition of Moringa leaf extracts to legumes increased duration to first germination of beans, increased germination percentage of cowpea, reduced germination percentage of groundnut seed and caused lower seedling

Table I: Effects of Moringa leaf extract on seed germination (%), seedling survival (%), hypocotyl development, hypocotyl and radicle lengths (cm) and duration (days) to first germination of beans, cowpea and groundnuts

Tree/crop species	Duration to first germination (days)	Germination (%)	Hypocotyl length (cm)	Hypocotyl presence	Radical length (cm)	Seedling survival (%)
Beans						
Moringa	2.0a	93.3a	2.2a	83.3a	7.3a	83.3a
Distrilled water	1.0b	93.3a	2.2a	86.7a	7.0a	86.7a
Lsd	0.3	10.7	0.5	14.3	1.1	11.9
cv (%)	13.3	10.6	15.0	16.0	15.0	15.6
P value	0.001	0.001	0.001	0.001	0.001	0.001
Cowpea						
Moringa	2.0a	80.0a	1.8a	73.3a	5.2b	73.3a
Distrilled water	2.0a	76.7a	2.1a	76.7a	6.8a	76.7a
Lsd	0.3	10.7	0.5	14.3	1.1	11.9
cv (%)	13.3	10.6	15.0	16.0	15.0	15.6
P value	0.001	0.001	0.001	0.001	0.001	0.001
Groundnut						
Moringa	2.0a	66.7a	1.2a	16.7b	4.9a	56.7a
Distrilled water	2.0a	70.0a	1.4a	50.0a	5.7a	66.7a
Lsd	0.3	10.7	0.5	14.3	1.1	11.9
cv (%)	13.3	10.6	15.0	16.0	15.0	15.6
P value	0.001	0.001	0.018	0.001	0.001	0.001

Means in a column followed by the same letter (s) are not significantly different at P≤0.05, by Duncan's Multiple Range Test

survival in all legumes. However application of Moringa leaf extracts to legume seeds reduces hypocotyls formation and hypocotyls length resulting in delayed crop emergence and low field establishment of legume crops. *M. oleifera* leaf extracts reduces radicle length and root length of legume crops, which is likely to reduce field survival of legume crops.

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