

**EFFECTIVENESS OF INTEGRATING BIO-PESTICIDES AND
INTERCROPPING TO MANAGE PESTS IN FRENCH BEAN**

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**A Thesis submitted in partial fulfillment of the requirements for the award of
the Degree of Master of Science in Crop Protection**

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2017

DECLARATION

This thesis is my original work and has not been presented for an award of a degree in any other University.

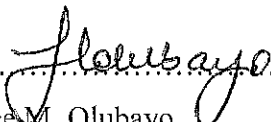
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ABSTRACT

French bean (*Phaseolus vulgaris* L.) production in Kenya has been facing a myriad of challenges with the recent being introduction of strict measures to inspect 10% of produce for maximum residue levels (MRLS) before entering EU (European union) market. The measures were introduced after detection of high levels of pesticide residues in Kenyan vegetable fresh produce. The measures have negatively affected fresh producers resulting in reduced incomes for small scale farmers. This study was therefore done to determine efficacy of integrating microbial, botanical, pyrethroid and potassium salts as well as integrating seed dressing, botanical, microbial products and intercropping to manage pest in French bean. Field experiments were carried out over two cropping cycles in Embu County. The first experiment involved application of bio-pesticide alone, potassium salt alone, combining two bio-pesticides, combining potassium salt with either a microbial, botanical or pyrethroid, combining potassium salt with a microbial or a botanical product and combining pyrethroid with a botanical and a microbial product. Control consisted of planting dressed seeds alone and application of thunder alone represented farmer's practice. Second experiment involved combining of seed dressing with botanical, combining seed dressing with a pyrethroid and botanical, combining seed dressing with maize-bean intercrop and spraying with a pyrethroid, combining seed dressing with a pyrethroid and microbial product, combining seed dressing with a botanical and microbial product, combining untreated seeds with a pyrethroid and a botanical. Control consisted of untreated seeds only while application of thunder alone served as farmer's practice. Data collected was on crop emergence, plant stand, nodulation and population of whitefly, thrips and aphids, bean fly, pod quality and yield. Plant stand and nodulation were significantly enhanced when potassium salt

was alternated with bio-pesticides. Integrating potassium salts with bio-pesticides significantly reduced bean fly (*Ophiomyia phaseoli*), whitefly (*Bemisia tabaci*) and thrips (*Frankliniella occidentalis* and *Megalurothrips sjostedti*) infestation by 9%, 5%, and 5% respectively compared to control. Alternating potassium salt with bio-pesticides and alternating potassium salt with a pyrethroid significantly increased pod yield by 5%. Application of potassium salt alone increased yield of extra fine pods by 3%, while application of thunder increased fine yield by 9% compared to control. The applied treatments had no effect on crop emergence however plant stand was significantly high at 78% for plots under seed dressing with bio-pesticides compared to other treatments. The level of nodulation was significantly ($P>0.05$) increased by 16% when seed dressing was combined with a pyrethroid and a bio-pesticide as well as on thunder alone. Combination of seed dressing, pyrethroid and bio-pesticide significantly ($P>0.05$) reduced bean fly infestation by 6% compared to control, while intercropping significantly ($P>0.05$) reduced whitefly and thrips infestation by 11% and 9% respectively. Pod yield was significantly increased by 14% when seed dressing was combined with pyrethroid and bio-pesticide, while combination of pyrethroid and bio-pesticides enhanced extra fine and fine quality yield at 11% and 12% respectively. The results indicated that combination of seed dressing with foliar application of bio-pesticides and potassium salts as well as intercropping can be used as alternative management options to chemical pesticides to manage pest in French bean. These options are safer compared to synthetic chemicals hence contributing in reducing synthetic pesticide residues enhancing compliance to MRLs requirements for export and domestic markets.

Keywords: French bean, Integrated pest management (IPM), Maximum residue levels (MRLs), Intercropping, Potassium salts