STUDIES ON LIQUID BIOFERTILIZER (*AZOTOBACTER*) AND BIOTERMITICIDES

by

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ABSTRACT

The exploration of natural solution to decipher the seen and unforeseen consequences of chemical based agriculture and pest protection is the need of the hour. Termites are the severe pests for timber and agricultural crops. The use of chemical termiticides is the only popular method of control. But the drawbacks associated with them are the reasons to look for the substitutes. The search for botanical termiticide as an alternative is important. The other component of bio based/organic agriculture is the biofertilizer, employing microorganisms for providing nutrient supply to the plants. The conventional biofertilizers used so far have some shortcomings. The present research therefore envisages the explication of strategies and products to overcome these problems.

Botanical and cyst based liquid formulations have been developed and tested at lab and field. The study was started with screening the botanicals for termite control. The active components were extracted using different solvents, testing of the active components and their combinations at lab and field and formulating the selected ones as emulsifiable concentrates (EC) and microemulsion (ME). *Pongamia pinnata, Nicotiana tabacum, Curcuma longa, Jatropha curcas, Madhuca indica, Datura alba* and *Ricinus communis* were found to have excellent termiticidal properties. The combination of hexane extract of *C. longa* and karanjin was found to be an outstanding combination with exceptional termiticidal activity giving 100 % mortality in 12 h at very low concentration and dose. The EC {20, 30, 40 EC of karanja oil; 10 and 20 EC of castor oil; 10 EC of karanja+castor oil (1:1) and 10 EC of karanja+castor oil (1:4)} and 5ME formulations were developed. The surfactant combination anionic (PEA07) and non ionic (FB), in the ratio

4:3 and 5:2 were selected for EC formulation. 10 (EC karanja + castor oil, 1:1) gave 100 % mortality in 24 h in lab and 6.83 % weight loss in field. In case of 5ME, the surfactants NP20EO (Nonylphenol20ethoxylates, nonionic) and 371 N (nonionic + anionic) were used and three formulations (C1, C3 and C5) with surfactant ratios 0:20, 1:1 and 5:15 selected. C5 was lastly selected on the basis of efficiency and efficacy. 100 % mortality was achieved by C5 within 12 h in lab results and only 6.7 % weight loss of wood in field experiments as compared to control (79.8 %).

Regarding, the development of cyst based *Azotobacter* formulations; native *Azotobacter* was isolated, cultured and purified. It was given stress conditions by adding additives, butanol and calcium carbonate and different temperature. The conditions for maximum cyst formation were selected and the cyst based formulations were further subjected to shelf life studies, dessication and temperature tolerance tests. The salt tolerance of the native strain was also tested and it was able to tolerant upto 4 % of salt. This salt tolerant strain was again subjected to the stress conditions and vegetative cells were converted to cysts. The formulations with maximum cyst formations were selected and undergone the shelf life studies. The cyst count was observed to be 10^9 in all the cases and shelf life was maintained to 20 months. The formulation was able to tolerate 12 days of dessication conditions and upto 45 ^{o}C of temperature. The longevity of cyst based formulations was also compared with carrier based formulations. The shelf life of carrier based formulation was only 3 months at room temperature and it was not able to resist the dessication conditions for even two days and unable to tolerate 30 ^{o}C of temperature. The field testing of the formulations showed positive effects on growth, yield and biochemical parameters on *Zea mays* (maize) crop and minimized the effect of salinity in salt stressed soil condition.

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