

The eco-friendly approach of 'Wrap and Plant' (W&P) developed in Yam against Plant Parasitic nematodes

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Abstract:

The Plant parasitic nematodes (PPN's) are now in focus of the world as they cause significant reduction in the yield of the plant. Yam is one of the important crop in West African belt and it is suffering from a great yield loss due to PPN especially *Scutellonemabradys*. Therefore, the researchers from North Carolina State University developed an amazing technique for Yam called Wrap and Plant (W&P). A foldable paper was developed mixing a banana fiber and corrugated cardboard sheet, this paper is used in wrapping of the Yam seed before sowing in the field. The Abamectin, an insecticide used in managing *Scutellonemabradys*, was infused into the paper in ultra-low volumes checked for compatibility with material and used in the field. Three treatments (i) an ultra-low volume dose of the insecticide was infused in the banana paper wrapped around the yam seeds (BP-Abm) (ii) banana paper alone (BP) and (iii) control farmers practice no wrap (FP) and sown in the heavily PPN infected field. The nematode population was checked in the Yam produce after harvest and also in the storage. The significant reduction of 80% was observed in the final population of nematodes in the BP-Abm treatment and a yield improvement of 28–57% was also recorded.

Introduction:

Pathogens infect plants and affect their yield, the tuber crops are mostly infected by many soil-borne pathogens. An appropriate example is the Irish famine of potato, where thousands of farmers starved to death. However, nowadays PPN's are becoming a menace which can cause an 80-100% loss in productivity. A plant parasitic nematode *Scutellonemabradys* (migratory endoparasite) causes dry rot in yam and also predisposes the tuber to fungal and bacterial infections. The population of PPN increased in yam (field and storage) leading to a considerable yield loss of 17-50% annually. This migratory endoparasite is propagated locally by yam seed pieces. However, the nematode enters plants through roots, cracks, and injured parts in the tuber pieces. The parasite feeds on the periderm and is restricted to 1-2cm of the outer layer, it continues to feed the parenchymatous tissues in storage. This feeding causes the cell wall rupture and cavities formation due to loss of cell contents.

The Wrap and Plant (W&P) technology for Yam:

Researchers of North Carolina State University conducted an experiment in three districts of Benin country of West Africa. Benin is one of the five most yam-producing countries in the yam belt of Western Africa contributing 92% of yam production globally. The scientists prepared a foldable biodegradable paper using banana fiber left over from harvest (4 parts) and old corrugated cardboard boxes (1 part). The resultant banana paper samples prepared were tested for compatibility with the abamectin insecticide to observe whether abamectin could bind strongly with the paper or not. Three treatments (i) an ultra-low volume dose of the insecticide was infused in the banana paper wrapped around the yam seeds (BP-Abm) (ii) banana paper alone (BP) and (iii) control farmers practice no wrap (FP) and sown in the heavily PPN infected field.

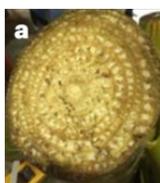


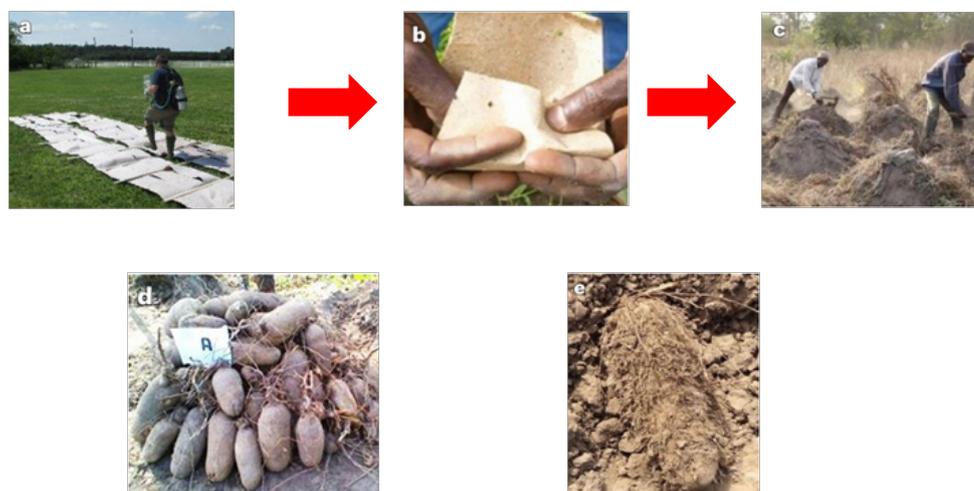
Fig 1. Photographs of raw materials used for making banana paper(a)Pseudostem-harvest waste of banana from which banana fiber was extracted (b) the corrugated cardboard boxes (Source: Plant-biomass-based hybrid seed wraps (Pirzadaet al., 2023).



Fig 2. Photograph of paper making from banana fiber and cardboard boxes (a) the slurry prepared from raw material evenly spread and dewatered to make fiber sheets (b) further dewatering and drying (c) converting dry material to paper roll (d) paper roll with tomato roots penetrating after 21 days of sowing wrapped in it (Source: Plant-biomass-based hybrid seed wraps (Pirzadaet al., 2023).

Improved yield of Yam through W&P:

The banana paper-infused abamectin (BP-Abm) improved the yield by 28–57%. However, banana wrap alone (BP) was also effective with an increased yield of 27–53%. A considerable reduction of 80% was observed in the final nematode population when the yam skin peels were examined. However, the per cent weight loss in BP-Abm was less than BP, and in turn, the per cent weight loss in BP was less than compared to FP which was observed by the researchers over 3-5 months in storage. They also observed reduced cracking and dry rot of tubers in storage in BP-Abm. The average cost-profit ratio increased from 59.93% to 79.3%. (Dedehouanouet al., 2022)



Conclusion:

The banana paper prepared is biodegradable and eco-friendly, they also released the insecticide slowly into the soil and extended the protection to the tuber. The porous nature of the paper locks the small molecules of the insecticide, and control release the insecticide which make them unique and suitable to the W&P for the seed. The preparation of paper is also not a constraint, the procedure can be followed in commercial mills over a large scale. The procedure to be followed is very simple and can even be followed by a simple farmer getting good quality produce and reducing dry rot and cracking of the tubers.

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