SUMMARY AND CONCLUSIONS

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We are a data-rich action poor country. Though India is a grain-surplus country and has over 45 million tonnes of wheat and rice in its godowns, over 250 million children, women and men go to bed partially hungry everyday. From being food-secure, India needs to become livelihood secure. And that is the biggest challenge facing the country today.

We should also recognise that our population is increasing every year nearly by 17 million. If our agriculture grows wrong, nothing else in our economy and social fabric will have a chance to go right. Now-a-days the cost of cultivation is very high due to various reasons - land is expensive, labour cost is high and alternative land-use opportunities are less. The unfortunate side of producing a surplus crop is that in spite of good production, farmers face a price crash. The growing social and government concern about the harmful environmental effects of chemical crop protection has led to stricter environmental policies and the substitution of chemical pest control by various integrated pest management strategies.

Over the past 50 years, the accelerated and prolonged use of organic synthetic chemical pesticides has resulted in an increasing incidence of high levels of resistance to these materials on the part of their targets. A recent summary has reported that at least 447 species of insects and mites, 100 species of plant pathogens, and 48 species of weeds are now resistant to control by chemical
pesticides. In many instances, resistance induced to one class of chemicals leads to cross-resistance to other chemicals, due to alterations in enzyme systems of the host organisms that can inactivate a range of chemical compounds. Chemical pesticides have a 7 to 10 years development time frame, with registration cost ranging from $20-$30 million. This expense is, in large part, due to the concern over possible high animal toxicities of such materials that necessitates long term toxicological testing on experimental animals.

Biologicals, because of their natural derivations, have the distinct advantages of being biodegradable, so that they do not leave toxic residues or by-products to contaminate the environment. They have a very high level of safety for humans, animals, fish and other non-target organisms, principally because they act by very different modes of action than most organic chemical pesticides that attack metabolic advantage is very important, because it impacts to a large extent the cost of development and registration of a new pesticide product. Biologicals, because of their high target specificity, typically require only short-term, toxicological tests, with the potential for registration within a year of submission and a total registration cost of $150 - $250 thousand.

The dark or hot spot is that we have many imbalances - commodity, regional and trade. We should now think of capitalising on this bright spot. ‘An unequal and unjust trade bargain’ should overcome with the innovative and important suggestion that India should press for a “Livelihood Box”. Eighty percent of our farmers belong to the small and marginal farmers category.
Our main aim in the present investigation is to overcome the mismatch between the methodology of extension services and the genuine requirements of farmers in the context of globalisation of agriculture.

Of all the biological agents that have been evaluated as pest control products, the most successful by far has been the bacterial insect pathogen *Bacillus thuringiensis*. Approximately 90-95% of the sales of all biological pest control products worldwide are of this bacterial agent, totalling approximately $50-$55 million in annual sales. *B.t.* products are of two types. The most predominant is *B.t.k* (*k* for variety *kurstaki*), and is sold under several trade names (e.g. Dipel, Thuricide, Bactospeine, Biobit, etc.) for control of a number of lepidopteran (caterpillar) pests of importance on forest trees, vegetable crops, cotton, and ornamentals. These products have been sold since the early 1960's, and the amount for the bulk of *B.t.* applications.

This product, sold under tradenames such as Teknar, Vectobac, etc., has achieved North American sales of $3-$5 million, although its most extensive use has been promoted by agencies such as World Health Organization in underdeveloped countries of Africa, Central and South America, and Asia.

Despite the fairly long history of *B.t.*, its expansion as a pesticide product has been very slow. In fact, usage of the *B.t.k* products has actually decreased over the last ten years, due primarily to the capture of the vegetable insecticide market by chemical pesticides. The major reasons for this failure to expand have already been alluded to, namely inconsistency of performance (especially when compared to the chemicals) and past inability to compete in price.
In importance of this point we have carried out our investigation and we were successful in lowering the cost of the B.t. production. The cost of B.t. when grown in standard medium is 55.23 Rs/lit. We have used different cheap sources such as mushroom stalks, a complete wastage of the industries with Rs. '0' cost and different peptones such as dipeptone, casein, gelatin, vegetable, soya, bacto, meat peptones for formulating new media. All the ingredients used by us in the present work were able to provide the required nutrition to the organisms grown and have shown very satisfactory results. The cost of the media was reduced to 15.98 Rs/lit. by using mushroom extract at a very reasonable and very low cost such that the farmers of our India will be benefited by this work.

This present study deducted that the media formulated for the production of B.t. possess the following advantages.

1) Media is very easy to prepare and does not require any complicated pretreatment for any constituents.

2) The media supported high growth of the strains.

3) The media supported toxin production and retained the toxicity. The level of control which these toxins inflicted to the insect, has been found to be equally effective to the toxins isolated from the standard medium.

4) The cost of raw material for fermentation is extremely low, so this media fulfill the motto of Indian scientist to provide cheapest biorational pesticide.

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Of all the media formulated the best media for the growth of *B.t.*
was found to be medium III with composition of 5g of yeast extract, 5g of NaCl, 750 ml of the mushroom extract per liter of distilled water and can be used at a cost of Rs. 15.98 per liter whereas, the best medium for the production of endotoxin was medium IX with composition of 10g of bactopeptone, 5g of yeast extract, 5g of NaCl per liter distilled water and can be used at a cost of Rs. 19.48/ltr.

A small farm is a factor of strength in precision and intensive agriculture. A small farmer is a euphemism for a farm family, which cannot take risks and which is struggling for existence. The most serious problem that Vidarbha farmers are facing and their struggle and risks can be overcome by the present work. This friendly technology can be introduced in the agriculture. This effort will bring smiles on the faces of farmers.