

## Use of Neem Biopesticide “Azadirachtin” for the enhancement of PUFA in Soyabean Seeds

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### Abstract

Polyunsaturated fatty acid (PUFA) is commonly found in plants oil. These are considered as essential fatty acid, meaning that they cannot be synthesized by the human body but are vital for normal metabolism. PUFA has been shown to lower the risk of heart attack<sup>1</sup> and other cardiovascular diseases<sup>1</sup>. There is limited evidence that may be useful as an add on for the treatment of depression. The DHA obtained through the consumption of PUFA is vital for grey matter structure of human brain, retinal stimulation and neurotransmission<sup>2</sup>. From our present studies *i.e.* effect of organic manure and the bio pesticide “Azadirachtin” on the quality of Soyabean seeds, it has been observed that the percentage of PUFA in the organic soyabean seeds sample is comparatively high *i.e.* 11.20%, 11.79%, 11.56 % during the successive years than the percentage of PUFA in the seeds obtained by the conventional method (11.14%, 11.54%, 11.28 %) during the year 2009, 2010 and 2011 successively. This shows that the organic soyabean seeds quality is quite better. Hence farming of soyabean by using bio-fertilizer and neem based bio-pesticides is preferable.

The striking feature of biopesticides is environment friendliness and easy biodegradability, thereby resulting in lower pesticide residues and largely avoiding pollution problems associated with chemical pesticides. Further, use of biopesticides as a component of Integrated Pest Management (IPM) programs can greatly decrease the use of conventional (chemical) pesticides, while achieving almost the same level of crop yield.<sup>3</sup>

*Key words:* Organic manure, bio pesticide, Azadirachtin, PUFA, EPA, DHA.

## Introduction

Plants oil such as soyabean is rich in PUFA which is used to lower bad cholesterol. To lower the bad cholesterol the role of PUFA is important in the food item. Recently research has shown that substituting PUFA reduces blood cholesterol level.<sup>4</sup>

The heart health benefits of unsaturated fatty acids over trans and saturated fats have long been recognized but now a study at Pennsylvania state university indicates that PUFA could lower cholesterol better than the MUFA. It is also linked with prevention of Parkinson's disease. Consumption of PUFA during pregnancy is very important for the fetal development. It is required during prenatal period for the formation of synapses and cell membrane. These processes are also essential

in post natal human development for injury response of the central nervous system and retinal stimulation. It suggests that a maternal diet containing insufficient amount of PUFA can lead to greater risk of decreased accretion of brain DHA of offspring.<sup>2</sup>

PUFA is a fatty acid and the general structure of fatty acid is a hydrocarbon chain with a carboxy group at one end and methyl group at the other end. The most abundant fatty acid have straight chains of an even number of carbon atoms. This chain length varies from 2-30 or more and the chain may contain double bonds. Fatty acid containing double bonds in the acyl chain are referred to as unsaturated fatty acid. A fatty acid containing two or more double bond is called a PUFA. The common name of this fatty acid is linoleic acid and it is the simplest PUFA.<sup>5</sup>



Linoleic acid

Mammals, but not plants lack the desaturase enzymes necessary to synthesize linoleic and  $\alpha$ -linoleic acid.

Although mammalian cells cannot synthesize these but can metabolize them by the introduction of further double bonds (desaturation) and by lengthening the acyl chain (elongation). Thus linoleic acid can be converted into  $\gamma$ -linolenic acid and di homo- $\gamma$ -linolenic acid into arachidonic acid. Using the same series of enzymes as those used in metabolize n-6

PUFA's, a linolenic acid is converted into EPA (eicosapentaenoic acid) which is then converted into DHA (docosahexanoic acid), involves the addition of 2 carbons. In mammals the pathway of desaturation and elongation occurs mainly in the liver.<sup>5</sup>

Soyabean oil is rich in PUFA, linoleic acid which may comprise as much as 75% of fatty acid present thus this oil is an important dietary source and also contain smaller amount of linolenic acid.<sup>6</sup>

## Material and Methods

**Soybean** [*Glycine max (L.) Merrill*] is known as "Golden bean" and miracle crop of the 20<sup>th</sup> century. Soybean tops in the world production of both oil seeds and edible oil. World harvest of soybean is more than 50 per cent of the total world oil seed production. India ranks fifth in the world soybean production during last two decades, with present area of 9.67 million hectares and 9.73 million tonnes production.<sup>7</sup>

Organo phosphate and organo chlorine pesticides are widely used for the soyabean crop but these are the toxic chemicals and having broad spectrum actions. The other drawbacks of the repeated use of pesticides includes (1) eradication of enemies of the pests, (2) increased level of pesticide residue in soil, water, food and fodder crops, (3) resistance of pests to pesticides in addition to the environmental pollution. It is clear that once used pesticides persist somewhere causing serious harm to mankind and their ecosystem.<sup>8</sup>

In order to overcome the negative effects of the chemical pesticides the uses of bio-pesticides is being encouraged all over the world.<sup>9</sup>

Azadirachtin a chemical found in neem is one of the most important biopesticides used, which is developed by Indian Agriculture Research Institute, New Delhi, India.<sup>10</sup>

This study has been carried out to see how the azadirachtin (C<sub>35</sub>H<sub>44</sub>O<sub>16</sub>) a neem based biopesticides can enhance the percentage of PUFA in soyabean without affecting the

crop yield and quality. In our practical work we have cultivated soyabean crop by two different methods in three different years i.e. 2009, 2010, 2011.

The two different methods are as follows:

**(1) Organic farming method:** By using Nadep compost, vermi compost and neem based biopesticides (Neem baan. Paanch patti kadha).

**(2) Conventional farming method:** By using Urea, potash, DAP, super and synthetic chemical pesticide (Triazophos).

## Results

After proper cultivation, growth, and harvesting the crop seeds have been collected for the percentage of PUFA analysis and the results obtained are as follows:

## Discussion

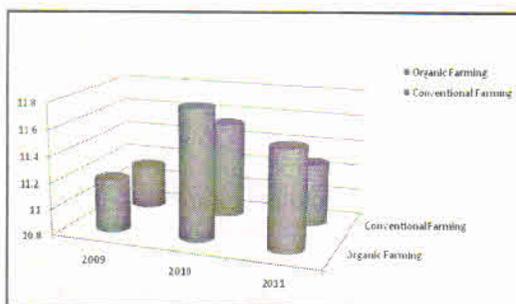
Polyunsaturated fatty acid (PUFA) is considered as essential fatty acid, meaning that they cannot be synthesized by the human body but are vital for normal metabolism. PUFA lowers the risk of heart attack and other cardiovascular diseases. They are useful as an add-on for the treatment of depression. The DHA obtained through the consumption of PUFA is vital for grey matter structure of human brain, retinal stimulation and neurotransmission.

As shown in the results obtained, the percentage of PUFA in the organic soyabean seeds sample is comparatively high i.e. 11.20%, 11.79%, 11.56% during the successive years than the percentage of PUFA in the seeds obtained by the conventional method

(11.14%, 11.54%, 11.28 %) during the year 2009, 2010 and 2011 successively. This shows that the organic soyabean seeds quality is quite better. Hence farming of soyabean by using bio-fertilizer and neem based bio-pesticide (Azadirachtin) is preferable. Since we did not use any chemical pesticides in the organic farming of soyabean, hence it contains negligible pesticide residue which means no adverse effect of chemical pesticide on human health. In addition to this by using biopesticides we can protect our environment from pollution.

Today's consumers are very health conscious and aware of the hazardous effect of chemicals in food product. Listening to the demands of customers, several multinational grocery stores and food processing companies are already requiring lower pesticide residues than the current government-mandated Maximum Residue Limits. Thus biopesticides like Azadirachtin can be used to reduce the number of chemical pesticides used to manage pests without sacrificing food safety or quality.

Year of cultivation	Organic Farming	Conventional Farming
2009	11.20	11.14
2010	11.79	11.54
2011	11.56	11.28



## References

1. C Watter, Willet, The role of dietary omega-3 fatty acids in the prevention of cardio vascular disease, *Journal of cardiovascular medicine*, 8, 42, Sep. (2007).
2. Alexandra J, Richardson P, A randomized, controlled trial of dietary supplementation fatty acid in children with developmental co-ordination disorder, *Pediatrics*, 115(5), 1360 (2005).
3. Kumbhar P.P., Solunkhe D.H., Borse M.B., Hiwale M.S., Nikam L.B., Pesticidal potency of some common plant extracts, *Pestology* 24(6), 51 (2000).
4. Lovejoy J.C., The influence of dietary fat on insulin resistance, *Current Diabetic Reports*, V 2, 435 (2002).
5. Merk & Co., You can control your cholesterol, A Guide to low cholesterol living, 14 (2009).
6. "Omega-3 fatty acids; fish oil, alpha-linolenic acid", Related terms, 1, 76-77, June 20 (2012).
7. Naronha N., Hindustan Times, Bhopal. Oct. 2, (2012).
8. Kaushal G.S., Krishi parampara-Sanrakshan aur Sanwardhan, Organic farming as a *Green Chemistry*, 5-8 (2011).
9. Attri B.S., Neem as a source of pest control material, *Pestology*, 4, 681-685 (1983).
10. Devakumar C. and Kumar, R. Total synthesis of Azadirachtin, *J - current science*, 52, 573, (10 Sep., 2007).