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# **SWITCHING OVER TO ORGANIC CULTIVATION AND ITS IMPACT ON LIVING WAGE AND EMPLOYMENT IN THE AGRICULTURAL LABOUR MARKET.**

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## **ABSTRACT**

The export performance of Indian agricultural commodities in the post WTO agreement on agriculture is not encouraging. Substantial increase of cost of farming due to steep increase of prices of chemical fertilizers, pesticides and seeds gradually make farming as non-profitable. This also reduces employment generation in agricultural sector. High improper use of chemical fertilizers and pesticides during the time of cultivation also creates different health hazards among the agricultural labourers. In this situation, this paper suggests that switching over to organic cultivation will be beneficial for both the farmer and agricultural labourers. As India is now enjoying few comparative advantages in exporting organic agricultural commodities, cultivation through organic method with bio-pesticides can help the Indian farmers to penetrate in vast global market mainly in developed countries and can sell the product at premium price. The organic cultivation will also give sufficient health security to the employed agricultural labourers, which is an important part of social security of these unorganized workers. Switching over to organic cultivation, will help the farmers cum employers to offer lower living wage to each employed labourers without violating social security norm of these unorganized workers and can generate sufficient employment in the agricultural labour market which ultimately will increase further if the developed countries following WTO agreement reduces tariff rates at the time of importing organic food products.

Key words: WTO Agreement, Organic Cultivation, Health Security, Living Wage, Employment.

JEL Classifications: F13, J28, J43, K31, N55, Q13.

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## **Introduction:**

After WTO Agreement on agriculture in 1995, the agricultural trade was for the first time brought within the discipline of multilateral trade rules. It was expected that the developing countries are likely to get more benefit from it due to their natural comparative advantage in agriculture in world trade. It was also expected that prices of almost all agricultural commodities to rise subsequent to liberalization of agricultural trade there by benefiting agricultural producers in those developing countries and these trade liberalization would provide stability to international as well as domestic prices of the agricultural commodities. But that has not happened because of serious impediments to multilateral trade liberalization. Actually developed countries' markets have not been very much accessible to the developing countries because of high tariffs on high value products and large tariff escalation. But India has shown little buoyancy in agricultural trade after economic liberalization and post WTO agreement on agriculture. The value of exports of the agricultural commodities has increased from \$6863 million in 1996-97 to \$8002 million in 2004-05 (Bhalla 2007). But the percentage of agricultural export to total export dropped from 20.5% in 1996-97 to 10.2% in 2004-05. Even the share of agricultural exports to total value of agricultural outputs in 2004-05 was only 5.71%. Rice and fish are the two major agricultural commodities exporting from India. Apart from that few cereals, fruits and vegetables are also exported. So globalization has thrown challenges for the policymakers of India. The new agricultural technology with the help of HYV seeds and

chemical fertilizers and pesticides spread to most of the states of India after 1980s and as a result of which, during 1980-81 to 1993-94 we observed high yield growth in agriculture. But after that we observe a significant slow down in the growth rate of agricultural outputs in India. At present it is around 4%. Evidence shows that the reforms also lead to substantial increase in the cost of farming. Both fertilizer and pesticide prices recorded a steep increase during 1990s (Reddy and Reddy 2007). 59<sup>th</sup> round of NSSO revealed that one third of the farmers claimed that farming is not profitable and another 40% are ready to give up farming in favour of job. It is also argued that the net income of the farming community is not sufficient enough to allow them to cope with the increasing social cost like health care and education. Gradual degradation of natural capital, especially soil due to over use of chemical fertilizer and pesticides also reduces the productivity of agricultural land. In this situation, agricultural growth can be revived both through increasing the yield growth of existing crops as well as through diversification of higher valued crop. These two strategies have to operate simultaneously. United Nations Food and Agricultural Organization (UNFAO) have urged the developing nations to boost exports of organic products to take advantage of booming market in the developed countries. Organic product means that product which is produced without using synthetic fertilizer and pesticides and very much health friendly. This product is cultivated with the help of Integrated Intensive Farming System. This system is essential for meeting the dual goals of more food and income from available land and water resources.

In this paper we are focusing on the importance of organic cultivation in Indian agriculture which can also provide little social security to the agricultural labourers and can generate more employment. This paper is divided into three sections. In Section-1, we shall discuss about the potentiality of Indian organic farm products in the international market. Then in Section-2 we shall discuss how cultivation through organic method can be beneficial for the agricultural workers and in Section-3, we shall develop a theoretical model and want to investigate the effect on living wage and employment in the agricultural labour market after farmer switches over to organic cultivation.

## **Section-1: Importance of Organic Farming in Indian Agriculture in the Globalised World:**

The concept of food quality has changed dramatically in recent years. It now refers not only the characteristics of the final products but also to the way in which it is produced. Consumers in the developed and few developing countries now become more health conscious and they prefer to consume organic foods. The developing countries can take the advantage of this. The emphasis of developing country's government on organic agriculture originates from two basic concerns: (i) use of hybrid seeds, intensive irrigation and excessive use of chemical fertilizers and pesticides now started lowering soil fertility and agricultural yields and (ii) from environmental point of view, where over and improper use of chemical fertilizers and pesticides is harmful for farmer's and labourer's health. To minimize this problem it becomes necessary for the farmers of the developing countries including India to switch over to organic cultivation which can reduce the use of chemical inputs during the time of production. It is also observed that small farmers can switch over to organic cultivation which is not only labour intensive but also have high demand in the international market. The world market for certified organic food is estimated to be worth of US\$ 23- \$25 billions in 2003 and is growing at roughly 19% per year (Kortbech and Olsen 2003). The global organic market growth is consumer led and can be attributed largely to increasing demand among a growing number of consumers concerned about health. Major international organic markets are observed in United States, Germany, U.K., Italy, France, Canada, Japan etc. Those countries are now importing large quantities of organic products due to their limited domestic production. Apart from China, India is now becoming a key exporter of organic agricultural products (Raynolds, 2004).

Indian farmers are exposed to import competition from highly subsidized agricultural production especially from the developed countries. They are told to diversify their production and increase export capabilities in order to survive. The share of the export of agricultural commodities in total export fall quite sharply between the period 1998-99 to 2000-2001. In this situation, India has tremendous scope for export of organic agricultural products where almost all synthetic inputs are

prohibited and production is done through natural inputs. In India there are three main types of farmers engaged in organic agricultural productions: (i) Farmers who mostly follow traditional methods of agricultural production where the knowledge is acquired over the past hundred years. They mainly produce for self consumption and almost have zero marketable surpluses. (ii) Farmers with medium to small-scale holdings who are informed and follow modern agricultural organic systems. They likely have marketable surpluses as well as same amount for exports. (iii) Private companies that have responded to market demands particularly in the developed countries by organizing large-scale conversions to organic system. They actually depend on contract farming with small and marginal farmers. Their intension is to convert the conventional farming practice to ecological and sustainable farm practice.

More than 80% of its organic agricultural products of India are now exported. These products get 20% to 30% higher price than that of inorganic products in the World market. It is true that bio-fertilizers and bio-pesticides are still not become very popular in India. This is mainly due to heavy advertisement of chemical fertilizers and pesticides for higher margin of the retailers. But the emerging and increasing international market opportunities for organic food products are conducive for the adoption of organic cultivation among small farmers of the developing countries including India. The question of competitiveness of Indian agriculture becomes much more important in the WTO regime, because Indian can derive the benefits of trade liberalization and can substantially increase the exports of agricultural commodities. It is commonly argued that the farmers can increase their income by diversifying from food grains to high value crops. In this situation organic food products can help the farmers to enjoy few comparative advantages in the international market. Initially India's organic farmers were facing ban from several countries following chemical pesticides residue found in the products sent from India. According to the rules, organic products should not have any presence of chemical fertilizers and pesticides. So more importance is now given on the utilization of bio-pesticides in organic cultivation. In 2004, India exported 31 organic products. Total export quantity was 6792 tons at a value US\$15.5 million. Key items exported were

fruits, vegetables, Basmati rice, sesame and spices. The major export market includes United States, Britain, Germany, Italy, France, Japan etc. At present the domestic market for organic foods is estimated about 1200 tons and its demand is growing. As part of the 10<sup>th</sup> Five Year Plan (2002-2007) the government of India, earmarked Rs.100 crores for promotion of sustainable agriculture in the country. The main component of this initiative have benefited exports from the establishing of national organic standards under NPOP (National Programme for Organic Production), putting in place a system of cultivation for products and establishing APEDA (Agricultural and Processed Food Export Development Authority) as the nodal agency to promote export opportunities. A recent development is that Indian bodies certifying organic products should soon be receiving European Commission Equivalence Status. This means that the European Commission feels the standards followed by Indian Certification Agencies are comparable to its own and as a result of which Indian organic products will be exempted from certification by European agencies. This will naturally bring down the cost of exports of the organic products and can help the Indian farmers to sale that at comparatively lower price in European market. Still excess demand for organic products in the world market is observed and export of organic products from India is very small compared even to the current size of world organic markets. So there is a huge scope for the Indian farmers to make farming profitable if they can switch over to organic method of agricultural production.

## **Section-2: Importance of Organic Cultivation for Agricultural Workers:**

Modern commercial agricultural practices involving chemical inputs such as fertilizers and pesticides have been associated with huge increase in food production particularly rice and wheat. But this high increase of production is not without problem. It is observed that in the post liberalization period, the employment growth in the agricultural sector is gradually declining. Dominance of small size of cultivatable land and high cost of cultivation generally prevents the farmers to employ more labour in the agricultural sector. But increase in population, gradual decline of cottage industries and village handicrafts, eviction of small farmers and tenants from

land and uneconomic holdings are causes of growth of labour supply in the agricultural sector which ultimately increases the rate of unemployment in that sector.

Since the agricultural labourers of India are mostly not organized, they can not fight for minimum wage and any other social security benefit. As the labourers are not permanently attached to any employer, the task of providing social security to a worker is indeed a complex one. Therefore the responsibility has to be borne by the state. Following the recommendation of Second National Commission of Rural Labour, government of India, the National Commission for Enterprises in the Unorganized Sector (NCEUS) is formed. The basic objective of the Commission is to decide the conditions of work of the unorganized workers including agricultural workers. So it proposed 'Conditions of Work and Livelihood Promotion Bill' in 2007. Here the commission recommends providing health security to each labourer. We know that most of the times, the agricultural labourers have to work in poor unhealthy conditions and more than the normal working hours. Exposure to pesticides both occupationally and environmentally causes a range of human health problems. It is estimated that world wide nearly 10,000 deaths happen annually due to pesticides, out of which about three fourth of these are occurring in the developing countries. A vast majority of the population in India (56.7%) is engaged in agriculture and is therefore exposed to the pesticides used in agriculture. Most of the farmers as well as agricultural labourers have no formal training of pest management or in safe methods of storage, handling and application. Actually following T.W.Schultz, farmers with low levels of investment in human capital may be efficient under static technological and economic conditions but are likely to be technically and economically inefficient in a technologically dynamic environment. Antle and Pingali (1994) on the basis of primary data in two rice producing regions of Philippines have proved that pesticide use has a negative effect on farmer and agricultural labourer's health which ultimately affects production because labourer's health has a positive effect on production. Painuly and Mahendra Dev (1998) had shown that increased use of chemical fertilizers and pesticides has created deficiencies of micro-nutrients and create an adverse effect on the health of the agricultural

labourers of India. They suggested the importance of biological control of pests and expansion of the use of bio-pesticides for sustainable product of agriculture. Almost same observation was observed by Clevo (2000) after his field study in Sri Lanka. So improper use of pesticides not only affect agricultural labourer's health and his out of pocket health expenses but also affects agricultural productivity through reducing the nutritional status of the labourers. Pesticides being used in agricultural fields come into human contact directly and indirectly. Prolonged exposure to pesticides results in acute and chronic health problems. These ranges from temporary acute effects like irritation of eyes, excessive salivation to chronic diseases like cancer, reproductive disorder, vomiting, fatigue, skin redness/ white patches, muscle weakness, chest pain etc. The sickness of the laborers increase out of pocket medical expenses and reduce possible full man days of employment of the labourers in the farm sector due to illness which ultimately affects their net earnings. So if we want to provide health security for the agricultural labourers, then government should encourage the landlords to switch over to organic cultivation because cultivation with the help of bio-fertilizer and bio-pesticides will definitely help the employed agricultural labourers to reduce the possibility of illness. Besides that the landlords should offer living wages not the minimum wage to his labourers. Minimum wage depends on the minimum needs of the worker. It provides not merely for bare sustenance of life but for preservation of the efficiency of the workers. But living wage enable the wage earners to provide for himself and his family not merely the bare essential food, clothing, shelter but also a measure of frugal comfort against the protection of illness. So higher out of pocket health expenses automatically demand higher living wage.

In this paper we will make a theoretical investigation to identify whether switching over to organic farming create any impact on living wage and employment in the agricultural labour market?

Here we consider a risk neutral farmer who is cultivating his entire plot of land with the help of hired labour. So his health is not affected due to improper use of chemical fertilizer and pesticides. But the health of the employed workers may be affected due to the above reason. It is assumed that the farmer has a belief on consumption efficiency argument when the wage income of the labourer

creates a positive impact on labour as well as farm productivity as mentioned by Bliss and Stern; (1978) and Pitt, Rosenwing and Hassan; (1990). But, labour experience productivity loss through health hazard due to improper utilization of chemical fertilizer and pesticides. So the farmer as well as employer has to offer living wage not the efficiency wage to the employed agricultural workers. Here the farmer has to decide both living wage and employment simultaneously at his profit maximizing level. We also have to derive the condition at which it will be profitable for the farmer to incline towards organic cultivation and then we shall have to determine its impact on living wage and employment. We shall also have to investigate the impact on living wage and employment if the farmer is getting more price premium in the international market.

**SECTION-3: The impact on living wage and employment in the agricultural labour market if the employer cum farmer completely switches over his agricultural production process through organic method.**

In this model, initially we assume that a landowner cum employer is producing certain crop in a given size of land. The crop can be produced either with the help of chemical fertilizer and pesticides or through organic method with chemical pesticides or totally with the help of bio-fertilizer and bio-pesticides. 'A' is the index of intensity of the use of fertilizer and pesticides during the time of agricultural production and is continuous in the closed interval  $A \in [\bar{A}, A^+]$ . Here A' is measured in monetary terms . Higher the value of 'A' ( $A \rightarrow A^+$ ) indicates higher intensity of the use of chemical fertilizer and pesticides during the time of agricultural production and lower value of 'A' ( $A \rightarrow \bar{A}$ ) indicates the inclination of the farmer towards organic farming. Here  $A^+$  indicates maximum possible use of chemical fertilizer and pesticide in the entire agricultural production and  $\bar{A}$  indicates zero use of chemical fertilizer and pesticides i.e. total inclination of the farmer towards organic cultivation with bio-pesticides. In this model higher 'A' has two effects (a) productivity enhancing effects and (ii) productivity destructing effect through reduction of the efficiency of the employed workers. It is true that a shift to organic cultivation involves a cost to the farmers in terms of loss of output. Farmers are generally denied access to developed country's organic markets for two to three years after beginning organic

management. A mere withdrawal of chemical inputs will not qualify the farmers or the farm to be certified as organic. There is normally a waiting period for at least three years for the residual effect to wear off and to get her products recognized as organic which involves a cost in term of certification. The cost is often too high to make it economical for the small and marginal farmers. But for simplicity of the model it is assumed that the conversion cost is zero and the farmer himself sells his product either in the domestic market or in the international market just after switching over to organic cultivation.

We know that the use of chemical fertilizer and mainly pesticides will make the agricultural labourer sick and then he has to bear few medical expenses from his own pocket which is represented as  $m(A)$  when  $m'(A) > 0$  &  $m''(A) < 0$ . Apart from that, due to sickness, the labourer may also loose few man days of employment which can be explained as  $\rho(A)$  where  $\rho(A) \in (0,1)$  and  $\rho'(A) > 0$ ,  $\rho''(A) < 0$ . So we can say that the higher intensity of the use of chemical fertilizer and pesticide may affect the total income of an employed agricultural labourer in two ways, i.e. (i) through reducing total possible full man days of employment and (ii) through bearing medical expenses from his own pocket.

Hence, the net income of an agricultural labourer after becoming sick becomes

$$EI_A = \{1 - \rho(A)\}\widetilde{W}_A H - m(A) \dots \dots \dots (1)$$

Here 'H' is the total possible man-days of employment of an agricultural worker in the entire agricultural season and  $\widetilde{W}_A$  is the wage rate in the farm sector at which the labourer would accept the job. It is independent of 'A',. Again each employed agricultural labourer may get employment in the non-farm sector where the wage rate is  $W_{NF}$  and possible days of getting employment is  $\widehat{H}$ . Here we assume for simplicity that, a labourer will not become sick in the entire time period if he works solely in the non-farm sector. So earnings of the same labourer from non-farm sector will become  $I_{NF} = W_{NF}\widehat{H}$ .

Now a labourer will work as an agricultural labour provided  $EI_A \geq I_{NF} \dots \dots \dots (2)$ .

As  $EI_A = \widetilde{W}_A H - \rho(A)\widetilde{W}_A H - m(A)$ , we have

$$(EI_A)_A = -\rho'(A)\widetilde{W}_A H - m'(A) < 0 \text{ and } (EI_A)_{AA} = -\rho''(A)\widetilde{W}_A H - m''(A) > 0$$

$$\text{as } m'' < 0 \text{ \& } \rho'' < 0 \dots\dots(3)$$

So we can conclude that the income curve of a labourer with respect to 'A' from agricultural sector will be negatively sloped and convex in nature.

Suppose, the minimum value of A is  $\bar{A}$  and at that situation, the expected income of the representative labourer from farm sector will be  $\overline{EI}_A = \widetilde{W}_A H - [\rho(\bar{A})\widetilde{W}_A H + m(\bar{A})]$ . Now,<sup>1</sup> we assume that  $\overline{EI}_A > I_{NF}$ .

The landlord cum farmer has to decide the level of 'A' at which rural labourers are available to for agricultural production. From Figure-1, it is clear that at 'e', the representative labourer is indifferent between farm and non-farm sector. Beyond,  $\hat{A}$ , the labourer will always work in non-farm sector. Here  $\hat{A} \leq A^+$ . But, when  $A \in [\bar{A}, \hat{A})$ , the representative labourer will always work in farm sector. So the farmer prior to any agricultural season, at the time of deciding the type of cultivation, should always keep the intensity of the use of chemical fertilizer and pesticides below  $\hat{A}$  to ensure the availability of labour in the entire agricultural peak season. Suppose the intensity of the use of fertilizer and pesticide in the entire agricultural production is represented as  $\tilde{A}$  when  $\tilde{A} \in [\bar{A}, \hat{A})$ . Now if the landowner cum employer wants to employ, 'N' number of homogeneous labourer in the entire agricultural season, then his net earning from cultivation will become,

$$\Pi(W_A, N) = \bar{p} \tilde{A} f\{e(W_A - \tilde{A})N\delta(\tilde{A})H\} - W_A N H \delta(\tilde{A}) - C(\tilde{A}) \dots\dots\dots(4)$$

From the above equation, it is clear that, the landowner believes instantaneous consumption efficiency argument. But here  $W_A$  is the *living wage* of an agricultural labourer which is decided by the farmer<sup>2</sup>. The labourers are assumed as the sole member of his family and he himself consumes the entire wage income after paying the medical expenses if necessary. As it is obvious that living wage is at least as greater than market wage, so in our model  $W_A > \widetilde{W}_A$ . In traditional

instantaneous consumption efficiency argument, the nutritional efficiency of an agricultural labourer totally depends on the wage income he receives where it is assumed that the entire wage is spent for food consumption. But here due to the presence of ' $\tilde{A}$ ', the nutritional efficiency of the labourer does not solely depend on  $W_A$  because higher ' $\tilde{A}$ ' negatively affects the nutritional efficiency as well as labour power of the labourer. So during the time of agricultural production, efficiency of a labourer, depends on  $(W_A - \tilde{A})$ .

We consider two important assumptions in our model and those are (i)  $W_A > \tilde{A}$  and (ii) Switch over cost of cultivation is zero.

Here  $C(\tilde{A})$  is total cost of utilized fertilizer and pesticides and necessary seeds. It is obvious that  $C' > 0$  &  $C'' > 0$ . So when a farmer switches over to organic cultivation with use of bio-pesticides, the cost of cultivation of the farmer will decline. It is also assumed that the entire produced agricultural commodity can be sold either in the domestic market at price ' $p_d$ ' or at international market at price ' $p_i$ .' Obviously, the farmer prefers to sale the product in the international market where there is high demand of organic agricultural products. If he can sell his entire product in the international market, he has to pay tariff ' $t$ ' for selling each unit of output. In that situation, her net earnings after selling one unit organic farm product in the international market will become  $\hat{p}_i = (p_i - t)$ . But if his product is rejected in the international market, then he can sell the entire amount in domestic market at price  $p_d$ . We here also assume that transportation cost is zero and no crop is destroyed after rejection from international market and expected earning of the farmer after selling one unit of output is denoted as  $\bar{p}$  which is obviously positively related with  $p_d$  &  $p_i$  and negatively related with ' $t$ '.<sup>3</sup>

So the objective function of the risk neutral farmer cum employer can be explained as

$$\text{Max}[\Pi(W_A, N)] = \bar{p} \tilde{A} f\{e(W_A - \tilde{A})N\delta(\tilde{A})H\} - W_A N H \delta(\tilde{A}) - C(\tilde{A})$$

Subject to (i)  $W_A H - [\rho(\tilde{A})W_A H + m(\tilde{A})] \geq W_{NF} \hat{H}$ , and (ii)  $W_A > \tilde{W}_A$  <sup>4</sup> .....(5)

Hence the Lagrange function can be explained in the following way:

$$L(W_A, N, \mu, \varphi) = \bar{p} \tilde{A} f \{e(W_A - \tilde{A}) N \delta(\tilde{A}) H\} - W_A N H \delta(\tilde{A}) - C(\tilde{A}) - \mu [W_{NF} \hat{H} - W_A H + \{\rho(\tilde{A}) W_A H + m(\tilde{A})\}] - \varphi (W_A - \tilde{W}_A) \dots \dots \dots (5A)$$

Now if the landlord wants to incline towards organic farming then obviously  $\tilde{A} \in [\bar{A}, \hat{A}]$ . So

$W_A H - [\rho(\tilde{A}) W_A H + m(\tilde{A})] > W_{NF} \hat{H}$ . Following consumption efficiency argument we also have to consider  $W_A > \tilde{W}_A$ . In the presence of two non-binding constraint, the above optimization problem (following Kuhn-Tucker condition) is converted in to unconstrained optimization problem when  $\mu = \varphi = 0$ .

The above optimization problem gives

$$\frac{\partial \Pi}{\partial W_A} = \tilde{A} \bar{p} f' \{e(W_A - \tilde{A}) N \delta(\tilde{A}) H\} e'(W_A - \tilde{A}) = 1 \dots \dots \dots (6)$$

$$\frac{\partial \Pi}{\partial N} = \tilde{A} \bar{p} f' \{e(W_A - \tilde{A}) \delta(\tilde{A}) N H\} e(W_A - \tilde{A}) = W_A \dots \dots \dots (7)$$

$$\text{Combining (6) and (7) we have } e'(W_A - \tilde{A}) = \frac{e(W_A - \tilde{A})}{W_A} \dots \dots \dots (8)$$

The above equation gives the equilibrium living wage  $W_A^*$  when  $A = \tilde{A}$ . The relation (3) establishes Solow condition (1979). It is also established that the living wage at profit maximizing level is directly independent of  $\bar{p}$  and 'N'. Solving equations (6) and (7) we also have the equilibrium level of employment 'N\*'. Now to check whether  $W_A^*$  and 'N\*' are the profit maximizing living wage and employment, we have to consider the Second order condition. We have

$$\frac{\partial^2 \Pi}{\partial W_A^2} = \bar{p} \tilde{A} f'' \{e(W_A^* - \tilde{A}) N^* \delta(\tilde{A}) H\} \{e'(W_A^* - \tilde{A})\}^2 N^* \delta(\tilde{A}) H + \bar{p} \tilde{A} f' \{e(W_A^* - \tilde{A}) N^* H \delta(\tilde{A})\} e''(W_A^* - \tilde{A}) < 0 \dots \dots \dots (9)$$

$$\frac{\partial^2 \Pi}{\partial N^2} = \bar{p} \tilde{A} f f'' \{e(W_A^* - \tilde{A}) N^* H \delta(\tilde{A})\} \{e(W_A^* - \tilde{A})\}^2 H \delta(\tilde{A}) < 0 \dots \dots \dots (10)$$

$$\& \frac{\partial^2 \Pi}{\partial W_A \partial N} = \bar{p} \tilde{A} f'' \{e(W_A^* - \tilde{A}) N H \delta(\tilde{A})\} e(W_A^* - \tilde{A}) e'(W_A^* - \tilde{A}) H \delta(\tilde{A}) < 0 \dots \dots \dots (11)$$

Now the Second order condition will be satisfied if and only if

$$\frac{\partial^2 \Pi}{\partial W_A^2} \cdot \frac{\partial^2 \Pi}{\partial N^2} - \left[ \frac{\partial^2 \Pi}{\partial W_A \partial N} \right]^2 > 0 \text{ i.e.}$$

$$D = \bar{p}^2 \tilde{A}^2 \left\{ f'' e'^2 e^2 N^* H^2 \delta^2(\tilde{A}) \left( 1 - N^* H \delta(\tilde{A}) \right) + f' e'' f'' e^2 H \delta(\tilde{A}) \right\} > 0$$

The above relation will happen if and only if  $N^* H \delta(\tilde{A}) > 1$  &  $f'' < 0$  &  $e'' < 0$ .....(12)

Hence, on the basis of (12) we can claim  $W_A^*$  and  $N^*$  are profit maximizing living wage and employment in the agricultural labour market when the intensity of the use of fertilizer and pesticide is represented as  $\tilde{A}$ . It is also true that  $W_A^* = W_A(\tilde{A})$  and  $N^* = N(\tilde{A}, \bar{p})$ .

So the indirect profit function of the landlord cum employer can be expressed as

$$\Pi(\tilde{A}, \bar{p}) = \tilde{A} \bar{p} f [e \{W_A(\tilde{A}) - \tilde{A}\} N(\tilde{A}, \bar{p}) \delta(\tilde{A}) H] - W_A(\tilde{A}) N(\tilde{A}, \bar{p}) \delta(\tilde{A}) H - C(\tilde{A}) \dots \dots \dots (13)$$

Proposition-1: *Switching over to organic cultivation reduces the living wage but increases employment generation in the agricultural labour market. But the reduced living wage is still higher than the market wage.*

Proof: Following Envelope theorem from (13), we have

$$\begin{aligned} \frac{\partial \Pi^*(\tilde{A}, \bar{p})}{\partial \tilde{A}} &= \bar{p} f [e \{W_A^* - \tilde{A}\} N^* \delta(\tilde{A}) H] - \tilde{A} \bar{p} f' [e \{W_A^* - \tilde{A}\} N^* \delta(\tilde{A}) H] e' (W_A^* - \tilde{A}) N^* \delta(\tilde{A}) H \\ &\quad + \tilde{A} \bar{p} f' e \{W_A^* - \tilde{A}\} N^* \delta'(\tilde{A}) H - W_A^* N^* \delta'(\tilde{A}) H - C'(\tilde{A}) \dots \dots \dots (14) \end{aligned}$$

Now  $\frac{\partial \Pi^*(\tilde{A}, \bar{p})}{\partial \tilde{A}} < 0$  provided

$$\begin{aligned} \bar{p} f [e \{W_A^* - \tilde{A}\} N^* \delta(\tilde{A}) H] - \tilde{A} \bar{p} f' [e \{W_A^* - \tilde{A}\} N^* \delta(\tilde{A}) H] e' (W_A^* - \tilde{A}) N^* \delta(\tilde{A}) H \\ + \tilde{A} \bar{p} f' e \{W_A^* - \tilde{A}\} N^* \delta'(\tilde{A}) H - W_A^* N^* \delta'(\tilde{A}) H < C'(\tilde{A}) \dots \dots \dots (15) \text{ holds when } \delta' < 0 \end{aligned}$$

High value of  $\tilde{A}$  indicates higher inclination of the farmer towards the use of chemical fertilizers and pesticides in the agricultural production. The negative relationship in (15) shows the condition at which the profitability of the farmer will decline from agricultural activity if he becomes more prone for green revolution technique in agricultural production through high use of chemical fertilizers and pesticides.

So if marginal net gain due to use of one extra unit of chemical fertilizer and pesticide is less than marginal cost of production, then the landlord as well as the employer will not utilize chemical fertilizer and pesticides intensively during the time of agricultural production, rather he will totally switch over to organic farming with bio-pesticide after keeping  $A = \bar{A}$ .<sup>5</sup> In that situation  $\Pi(\bar{A}, \bar{p}) > \Pi(\tilde{A}, \bar{p})$ .

Now from (8) it is clear that

$$\frac{dW_A^*}{d\tilde{A}} = 1 - \frac{e'(W_A^* - \tilde{A})}{e''(W_A^* - \tilde{A})W_A^*} > 1 \dots\dots\dots(16)$$

So when the farmer moves towards organic farming through reduction of  $\tilde{A}$  he will also reduce living wage and the *proportionate fall of living wage is more than proportionate inclination towards organic farming*. So when  $\tilde{A} = \bar{A}$  i.e. the situation at which the farmer totally implements organic farming, the living wage at profit maximizing level decreases and will become  $\bar{W}_A$ . According to our not binding constraint of wage, still  $\bar{W}_A > W_A$

So from (7) we can write  $\bar{p} f'\{e'(\bar{W}_A - \bar{A})\delta(\bar{A})NH\} > \frac{\bar{W}_A}{\bar{A} e(\bar{W}_A - \bar{A})} \dots\dots\dots(17)$

As the living wage have already reached at subsistence level, the above inequality will again come back to equality provided 'N\*' rises to 'N̄' which proves that organic agricultural production requires significantly greater labour inputs than the conventional forms. As labour is not a constraint, organic cultivation can help the unemployed or underemployed labour in the rural community. Here it has to be remembered that  $f' > 0, f'' < 0, e' > 0$  &  $e'' < 0$ . So after switching over to organic cultivation, the living wage reduces to  $\bar{W}_A$  and employment rises to  $\bar{N}$ . It is also observed that the gap between the living wage and existing market wage also becomes minimum. So the farmer can provide health security to the employed agricultural labourers at minimum living wage. Now at  $A = \bar{A}$  i.e. the situation of total adoption of organic farming during cultivation with bio-pesticides, the profit function of the farmer becomes

$$\bar{\Pi} = \bar{p} \bar{A} f'\{e(\bar{W}_A - \bar{A})\bar{N} \delta(\bar{A})H\} - \bar{W}_A \bar{N} \delta(\bar{A})H - C(\bar{A}) \dots \dots \dots (18)$$

Proposition-2: *Employment in the agricultural labour market will further increase provided domestic price or international price of the produced crop increases or tariff rate on organic agricultural commodities in the developed countries decreases. But that will keep the living wage rate unchanged.*

Proof: Implementation of Agreement on Agriculture under WTO agreement results in reduction of domestic support in OECD (Organization for Economic Co-operation and Development) countries which should in turn raise international prices of agricultural commodities and improve export prospects for Indian and other developing countries. The organic food components can also be sold at premium price in the international market. So in our model  $\bar{p}$  will increase due to higher value of  $p_i$  and lower value of 't'. We know that profit of the farmer will increase with  $\bar{p}$  if and only if  $\frac{\partial \bar{\Pi}}{\partial \bar{p}} > 0$ . Solving equations (6) and (7) with the help of Cramer's rule, we have

$$\frac{d\bar{W}_A}{d\bar{p}} = 0 \text{ and } \frac{d\bar{N}}{d\bar{p}} = \frac{\bar{p}(f')^2\{(e')^2 - e''e\}}{D} > 0 \dots \dots \dots (19)$$

**Conclusions:**

After liberalization, farmers of the developing countries including India were encouraged to shift from growing mixture of traditional crops to export oriented cash crop. Initially that required for more inputs of pesticides, fertilizers and water than traditional crops. But liberalization policy reduced subsidy on chemical fertilizers and pesticides. So we observe tremendous hike in cost of cultivation in each unit of land. This also reduces the employment generation in the agricultural sector. In this situation, if the employers have to provide living wage (which is higher not only than minimum wage but also market clearing wage) to the employed labourers to maintain their social security, the farmers will have no other option but either to stop production or give more importance on family labour force during the time of cultivation which ultimately will reduce employment generation in the agricultural sector further. In this situation, growing demand of

organic food components in the international agricultural commodity market will give new direction of Indian agricultural products. A major advantage of organic farming is the reduced cost of inputs. More over it provides better yields and higher profit to the farmers than conventional cultivation.

This paper establishes that switching over to organic farming is beneficial for both the farmers and the employed agricultural labourers. Removal of the use of chemical fertilizer and pesticides improves productivity, man days of work as well as employment of the agricultural workers in the entire agricultural season. This also will reduce the medical expenses and can provide sufficient health security to these informal workers. The farmers can give low living wage daily to each worker; even that the expected earning of a labourer in the entire agricultural season becomes more than his next best alternative source of income from non-farm sector, because they now lose less number of days of employment due to sickness and can spend minimum amount for medical expenses. From the point of view of the farmers, switching over to organic cultivation would have big effect on productivity because the productivity loss from reduced chemical pest and fertilizer control is offset by the productivity gain from improved health of the labourer and less man days of waste due to illness. They can now generate more profit from same unit of land even after generating more employment. Reduction of tariff on agricultural commodities in the developed countries further increases the profitability of the farmer through selling it's organic product in the international market and this also will help him to generate more employment in the agricultural sector at unchanged living wage.

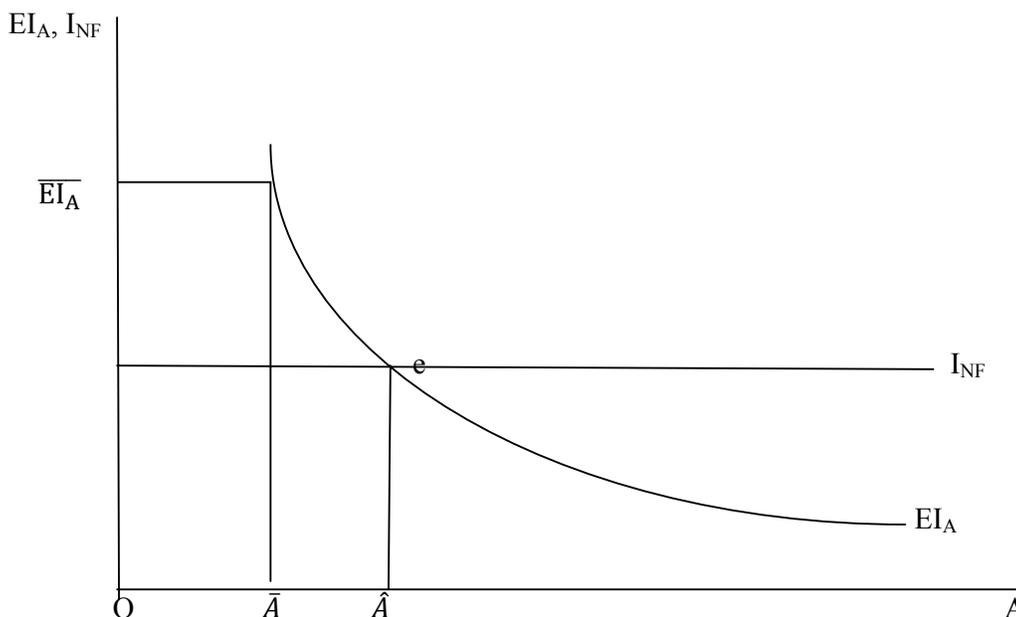


Fig-1

<sup>1</sup> Here it is clear that  $EI_A$  totally depends on 'A' but  $I_{NF}$  is independent of 'A'.

<sup>2</sup> A 'living wage' is the wage which allows the wage earners to afford housing, food, health care and a certain amount of transport. In case of 'efficiency wage' the labourer can utilize that wage only for food consumption. As here the labourer himself bears the own out of pocket medical expenses, to maintain the nutritional efficiency of the labourer, the landlord here offers not the efficiency wage but the living wage. Obviously the living wage is more than efficiency wage where following 'efficiency wage' literature that is obviously more than the neoclassical market clearing wage in a labour abundant rural economy.

<sup>3</sup> Following WTO agreement there will be gradual reduction of tariff on agricultural commodities in the developed countries which ultimately will improve the net earnings of the developing countries from exporting agricultural products.

<sup>4</sup>  $\widetilde{W}_A$  is the minimum wage in that agricultural labour market. Here following traditional literature of consumption efficiency argument, the living wage should be always kept above minimum wage level.

<sup>5</sup> The landlord perceives that higher intensive use of chemical fertilizer and pesticide may not enhance profitability, because it directly affects the efficiency of the worker and their productive capacity. Besides that it will also increase the cost of cultivation. So he wants to keep 'A' as low as possible. So in this single period model, at equilibrium  $A = \widehat{A}$ .

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