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Sugarcane

Rice (Paddy)

Wheat

Cotton

Mission Statement of API

To provide professional inputs to agriculture policy and recommendations relating to major and minor crops for meeting long-term objectives towards enhancing production.

MUSSADAQ MOHAMMAD KHAN
CHAIRMAN, API

PREFACE

Pakistan Journal of Agricultural Economics is a technical endeavour of the professional Agricultural Community in general and Agriculture Policy Institute in particular. Pakistan Journal of Agricultural Economics was first published in 1990. From the date of inception it has more than 20 year long history of publication. Its volume 7 was published in May 2011 after lapse of 3 years. It was a great effort of the Agriculture Policy Institute faculty and staff who made effort for its prompt publication with quality output. Their effort is really commendable.

2. Current issue of Pakistan Journal of Agricultural Economics Volume 8 has been published in October 2011 as a quarterly publication. Pakistan Journal of Agricultural Economics Volume 8 contains policy analysis on Agricultural Development and Food Security; Impact of Informal Economy with Specific Reference to Agriculture Policy Issues; Impact of Agricultural Policies on Yield of Crops; Pak Punjab vs Indian Punjab; The Developmental Impact of Agriculture Subsidies; Cotton Transport Model, Cultivation of Sugarbeet in Khyber Pakhtan Khwa and Comparative Economic Efficiency in Production of Major Crops in Pakistan. Efforts made by the Agriculture Policy Institute staff are highly appreciated as they have made it possible in bringing it out in short span of time.

3. On October 26, 2011 Government constituted Ministry of National Food Security and Research (MNFSR). Agriculture Policy Institute (API) was put under the umbrella of National Food Security and Research Division. Pakistan Journal of Agricultural Economics Volume-8 is the first publication of API under new arrangements.

4. Agriculture Policy Institute staff feels proud on being Attached Department of Ministry of National Food Security and Research. API staff hopes that it would attain new technical heights under the able patronage of MNFSR.

5. I hope that Pakistan Journal of Agricultural Economics shall be found very useful by the planners, researchers, policy makers and all concerned with the subject.

6. At the end I fully appreciate the efforts of those professionals, who contributed articles and their personal staff who made timely efforts.

October, 2011

Mussadaq Mohammad Khan
Chairman, API

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I. AGRICULTURAL DEVELOPMENT AND FOOD SECURITY

By

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1. Abstract

The principle bottleneck to increased supply is the set of public goods - policy analysis, technology, credit, farmer's organizations, and infrastructure- all of which are essential complements to private sector farmers and the businesses serving them. Governments must of course leave the donor fashion of favoring small unrelated projects, for focus on the aggregate growth and the national institutional capacity essential to that growth.

2. Basic Theme

The basic theme of this paper is simple. The path to food security leads from growth in agricultural production. More fully, the path is from agricultural production to increased farm incomes to reduced poverty to food security. It is the sequence that breaks the back of poverty and provides food

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* Invited Lecture II/24 PSDE, Agricultural Development and Food Security, The 24th Annual General Meeting and Conference, 31st March – 02nd April, 2009, The Marriott, Islamabad

security for most of the population. It is an odd sequence because it starts with raising the incomes of the not so poor that then drive large employment multipliers to lift the poor. In that context direct action programs to deal with the still significant residual food insecurity and poverty become manageable.

Why has agricultural growth been so neglected given these powerful relations? Background to the explanation is the urban orientation of most governments in Asia, Africa and Latin America- a tendency countered by foreign aid prior to and including the green revolution period - but strongly reinforced by foreign aid in more recent decades.

Two powerful intellectual forces backed the turn away from agriculture. Amartya Sen (1983) presented a powerful argument that famines (and presumably food insecurity more broadly) are phenomena of lack of purchasing power of the poor not a lack of food. It took little simplification to direct attention to means of directly increasing incomes of the poor rather than increasing the supply of food. The discovery that the poor are largely rural but in rural non-farm occupations led to looking for ways of increasing their incomes directly through small and medium non farm enterprises and a turn from agricultural production.

Concurrently, the World Bank has provided empirically based paper after proper substantiating that it is growth that reduces poverty. When those papers were placed in the context of emphasis on unfettered markets as the foundation of growth and hence a very limited role for government, the result was lack of support for the massive provision of public goods that are essential to agricultural growth. The response to the view that it is not growth per se but the right structure of growth that reduces poverty was that if agriculture was important the market would see that agriculture grew. Once a country reaches middle income status agriculture is of only modest importance to GDP growth but still dominates employment and poverty reduction. In that context, agriculture has virtually disappeared from foreign aid budgets and encouraged governments of low and middle income countries to minimize provision of the public goods so critical to small farmer agriculture.

The paper proceeds along five lines. First it examines the statistical evidence on relationships to poverty decline and the evidence explaining those relationships. Second, it examines the contemporary global food situation and its relation to food security. Third, it prescribes short run measures for dealing with a global circumstance of high food prices and concludes that most low income countries, specifically those of Sub- Saharan

Africa, will not be protected and that the brunt of the problem will fall on the poor of those countries. Fourth, the key elements for increasing food production are outlined. The paper ends with a set of conclusions specific to Pakistan. As the paper unfolds, and much seems common sense, it must be remembered that we are in a mess with respect to food security because this common sense is consistently ignored.

3. The Relation between Agricultural Production and Food Security

The following brief review is to achieve three purposes. First, is to show the long history of evidence of the close association between agricultural growth and poverty reduction and hence food security. Second is to show the breadth of evidence across countries. Third, is to explain those relationships. That will lead to policy conclusions for reducing poverty and increasing food security.

3.1 The statistical association of agricultural growth and poverty reduction

Prior to the 1970's, the agricultural production growth rate in India did not trend upwards. It did fluctuated considerably from year to year with fluctuations in weather. Ahluwalia (1978) showed a close correlation between agricultural production fluctuations and poverty. When the weather

was good agricultural production increased and poverty declined and conversely. The association was very strong. Dharm Narian (published in Mellor and Desai 1985) pursued those relationships and provided additional detail, confirming the basic relationship.

More recently, a substantial number of statistical studies analyzed these relationships across countries or regions of countries and over time. Ravallion and Datt (2002) in a cross section of Indian states showed that agricultural growth sharply reduced poverty and manufacturing growth had only a small impact. They also showed a substantial lag in the full effect. Timmer (1997) in a cross section of countries showed a similar relationship, but manufacturing growth showed no impact on poverty. Timmer showed that large farms had little impact on poverty reduction. Thirtle (2001) showed the same relationships. Ravallion and various colleagues showed similar results for several Asian countries. These results require modification of the simplistic position that economic growth reduces poverty. Yes growth matters, but the structure of that growth matters more.

3.2 Explanations of the relation between agricultural growth and poverty reduction

Explanation of the relationship between agricultural growth and poverty reduction takes two courses. One has to do with food prices and

wage rates and the other with employment and wage rates. The first tends to dominate in closed economies, the latter in open economies. In an open economy changes in domestic production and consumption have their impact on prices muted by trade -it is global prices that rule the domestic scene, not the product of domestic changes in supply and demand. However, even with open economies, transaction costs provide a substantial gap between import parity and export parity prices, allowing domestic forces to influence prices within that often wide range. The poorer transportation infrastructure and the working of domestic markets the stronger the price effect.

3.3 Price effects

The food price effect on poverty is obvious. The poor spend a high proportion of their income on food and so high (rising) food prices are deleterious to the poor (Mellor 1978.) Simplistically, a 50 percent increase in the price of food causes a 40 percent decline in real income of the poor and a roughly 40 percent decline in food consumption. There is no escape. For the poor, non-food expenditure is small and probably as essential to survival as food. The diet is already dominated by low cost calories and so that shift is modest also. But, it is worse. High income people collectively do reduce livestock consumption somewhat in response to higher prices and that

provides a modest reduction in demand for grain. But globally the forces reducing consumption by the poor are the main drivers of global adjustment of supply and demand for food. The paper will return to this theme later.

Of course a significant proportion of the rural poor have a small plot of land, but the poor are net buyers of food. Most of their production is consumed at home but even if they sell some at harvest they buy back a larger quantity.

The relation is a little more complex because higher prices to the farmers who produce the surplus, while they reduce the real incomes of the poor through the direct effect on their real income, the higher incomes of farmers provide more employment through increased purchases of goods and services produced by the poor (Lele and Mellor 1981) However, far better for the poor is raising farm incomes through cost reducing technological change that lowers costs and increases the quantity produced. Then the poor benefit from some combination of lower prices and higher employment (see the next section for the employment impact.)

One other price relationship is important. When food prices decline that tends to reduce the real price of labor and thereby increases employment

and conversely when food prices rise. Thus, the poor benefit from lower food prices either directly in their cost of living or indirectly through increased employment and conversely they lose from rising food prices. These complex relationships are spelled out in Lele and Mellor (1981).

3.4 Employment/wage rate effects

In a fully open economy food prices are determined by global supply and demand. In that case increased agricultural production does not depress prices and farm income rises. In agricultures dominated by small commercial farmers their spending in the local economy drives employment growth, poverty declines and food security increases. (Mellor and Ranade 2008, Mellor and Lele 1972, Mellor 1985, 1992). The rural population is conveniently divided into small commercial farmers and rural non-farm population.

Small commercial farmers typically comprise somewhat less than half the rural population, control abut 80 percent of the land and hence of agricultural income (Mellor 2002, Mellor and Gavian 1999, Mellor and Usman 2006, Barrios and Mellor 2006.) They have incomes well above the poverty level, spend half or less of income on food and so produce more than

twice the amount of output to satisfy their food needs, the rest being sold to provide the other components of consumption. They buy inputs, sell output, take up new technology and require credit (see below). Farmers typically spend on the order of half their incremental income on locally produced non-farm goods and services (Bell, Hazell and Slade 1982, Bouis 1999, Delgado et. al 1989, Hazell and Ramaswamy 1991.) About one quarter goes to increased food consumption (higher value food) and one quarter to purchases from urban areas including imports. It is the half of increments spent on the local rural non-farm sector that drives the statistical relation between increased agricultural production and poverty. Note that agricultural production increase is largely associated with technological change that increases yields per hectare, but also increases labor productivity substantially (e.g. Rao 1975.) Thus it is the multipliers to the labor intensive rural non-farm sector that has the big impact on employment, poverty reduction and food security.

Timmer (1997) shows that in agricultures dominated by large, often absentee, landowners poverty is not reduced by agricultural growth. That is because rich farmers do not spend a high proportion of increments to income on rural non-farm goods and services. The large holdings in Sindh would fit

this pattern. They spend largely on capital and import intensive goods. Thus the focus for poverty reduction is on the small commercial farmer.

Somewhat more than half the rural population is comprised of rural non-farm families. Most of the poor fall in this category (Bhalla 2004.). It includes those with land areas too small to provide a poverty level of income - those families typically earn over half their income from the rural non-farm sector. The poor are laborers, their nominal income determined by the amount of employment and the wage rate in the rural non-farm sector. They produce almost entirely non-tradables (Delgado et. al 1998, Liedholm and Meade 1987, Meade and Liedholm1998) Thus, the amount of employment is determined by local demand and the primary source of that local demand is small commercial farmers. That is why efforts to increase income in the rural non-farm sector are doomed to failure unless farm incomes are increasing to provide growth in effective demand for local non- tradables.

The reason why manufacturing growth has so little impact on employment growth lies with its integration into the competitive global economy. It is essential to continually reduce cost of production and in labor intensive industries that will mostly be achieved by increasing labor

productivity. Thus, it is all too common to find the elasticity of employment with respect to manufacturing to be zero.

There is a large literature supporting these relationships. Bell, Hazell and Slade 1982, Hazell and his colleagues 1991, 1983, Delgado et. al. 1998, Fan and colleagues 2005, 2002, and Haggblade and colleagues 2008, 1989, 1991 have contributed a large data based literature. Rangarajan (1982) approaches the same issues from a macro economic modeling point of view with the same conclusions. Mellor and his colleagues provide data for several countries showing the dominance of farm incomes in driving the rural non-farm sector (Mellor 2002, Mellor and Ranade 2008, Mellor and Usman 2006, Mellor and Gavian 1999, Gavian and et. al. 2002, Barrios and Mellor 2006.) These studies show that with rapid agricultural and non-agricultural growth 80 percent of employment growth is driven by agriculture and its multipliers. Johnston and Kilby (1975) provide data for the production linkages of agriculture with the rural non-farm sector.

The World Bank Development Review (2008) and the Haggblade et. al. (2008) review is clear on these relationships. They mention that there are other income sources driving the rural non-tradable sector besides farm incomes, such as remittances, tourism, nearby urban areas. They do not

quantify these relationships. Mellor and his colleagues show that even in remittance strong areas they are very small e.g. less than 10 percent as important as farm incomes in driving the rural non-farm sector. Tourism is minuscule in aggregate. Urban demand seems to have links only with very close areas. Thus, it is farm incomes that drive the process, consistent with the overwhelming data stated earlier. It is unfortunate that the recent reviews do not underline this point.

3.5 Circumstances of famine with ample supplies of food

There are a few circumstances in which famine strikes with an abundance of food. They both involve sharp decline in purchasing power of the poor. The usually cited example is drought in the famine prone areas of Ethiopia. In that case the drought forces divestment of livestock, depressing prices and greatly lowering incomes. At the same time cereals production in the less drought prone areas will have held up and of course livestock demand for cereals declines. There is an abundance of food but lack of purchasing power. Similarly the dislocations of war may remove the poor from their sources of livelihood. These are exceptions to the powerful role of food production discussed here.

4. The Contemporary Global Food Situation

The contemporary global food situation is effectively analyzed in the context of the preceding analysis. Recently food prices spiked at very high levels which brought a sense of crisis to concerns for the poor. No one disagreed that the problem of the poor was driven by high prices of food. The spike in prices was due to export restrictions placed by several major exporters, particularly of rice, and by speculative forces. However, the underlying problem is a higher rate of increase in demand for food relative to increase in the supply of food. That imbalance will become more pressing when the world economy recovers. Even now, food prices have come down less than most other commodity prices (FAO-Stat.)

The driving force is the rapid growth in income for large numbers of people, particularly including China and India, in the context in which global food production had slowed, again particularly in Asia (FAO-Stat). The result was demand growing faster than supply over large geographic areas with resultant strong upward pressure on prices. That circumstance can be expected to resume and continue for some time.

5. How Does the World Adjust to Demand for Basic Food Staples Shifting Faster than Supply?

As analyzed above, the adjustment to food scarcity is made almost entirely by poor people. The poor have the most elastic demand for basic food staples, not out of preference, but out of necessity. Because the adjustment is made by the poor protective measures for some concentrate the problem on the unprotected. The more are protected, the more the leverage in disadvantaging the remaining poor. Measures to reduce the misery of some increases the misery of others. Within countries the "remaining poor" are the most politically disenfranchised -that is the most silent. Across countries it is again the most silent countries that absorb the pain.

The following discusses measures that individual countries may follow to protect their poor from high food prices. That will be followed by discussion of the impact on those not protected, why they are not protected, and what can be done.

5.1 How to protect some of the poor at the expense of other poor

Given that the adjustment to higher prices due to a global imbalance between food supply and demand is by the poor, measures to protect the poor simply drive up food prices unless supply is increased. In the short run, that

can only occur through decreased exports or increased imports, tightening the supply demand balance in other countries. It is reasonable for individual countries to try to protect their poor even at the expense of the poor in other countries. Rich countries may assist in that effort, either for strategic reasons or in ignorance of the consequences in other countries of their actions.

Food stock management can smooth the adjustment of food consumption by the poor - less up in good crop years and less down in the poor crop years. However the random nature of food shortfalls makes carryover stocks commercially unprofitable. Governments do stock and of course private individuals, farmers and to some extent consumers, do stock. In these cases stocks may buffer the first year's shortfall, but run out before a second year. That is why a second year of drought is far more deleterious for the poor than the first year.

A theoretical exception to the above is rationing food to the more well to do. It is common in wartime to ration food to all, in effect preserving consumption by the poor at the expense of reduced consumption by the rich and taking the upward pressure off prices. Rationing is a clear recognition that measures to protect the poor do not work unless supply is increased or consumption by the more well to do reduced by non market forces. Is

explained in terms of a general shortage in a period of national crisis, usually war related, and a sharing in the pain of that crisis.

In the context of high food prices, protective measures are different for the urban and the rural poor. For food exporting countries, of which there are very few with large populations of poor people, restriction on exports increases local supply relative to demand and damps price increases. It is also common to try to recoup or minimize costs of distribution to the poor by compulsory procurement from farmers at below free market prices. That is often facilitated by preventing shipments from surplus areas driving down the local price, then buying at that price for shipment to other areas. Note that consumption is increased in the cordoned off areas because of lower prices to all consumers and in the other areas by reducing the price of food to the poor. The consequent reduction in farm prices has two consequences.

First, it is a disincentive to production- which could be but rarely is more than matched by efforts to reduce cost of production by agricultural growth policies. Second, it reduces farm incomes and hence the purchasing power to the rural non-farm sector, reducing income of the poor rural non-farm population in those areas. Thus part of what the poor gain from lower prices is taken away by lower employment-with a lag in the latter. In other

parts of the country market food prices are higher than they would otherwise be because of the lesser supply on the market. The poor who receive the procured food at a low price are protected the silent poor are not - the burden falls on them.

The urban poor are more easily protected than the rural poor because they are concentrated in small areas. For the urban poor the usual approach is to provide subsidized food - usually through some type of subsidized food availability normally with a rationing system for the subsidized food. In practice the difficult problem of restricting access to the poor is at best imperfectly solved and at worst the allocations go largely to those whose diets were not being substantially restricted. A substantial literature reviews the many variants of this approach and the details of the more likely to succeed approaches.

As for rural areas, urban public works programs could be instituted with the advantage of the self selection of the poor to participate. This is rarely done, probably because of the likelihood that the urban poor have some occupation, even though low paying and are suffering more directly from the price escalation.

The principal caveat, often ignored, for urban programs is that protection of the urban poor should not widen the real income gap between the urban poor and rural poor. If that gap widens it will encourage additional migration to the urban areas thereby greatly increasing the total costs of the program.

For rural areas the problem of restricting access to the poor, the preferred approach is employment guarantees that produces public works such as roads that provide the basis for increased future agricultural production. That may be a food for work program, which ensures that the supply matches the increment to income. It may also be a cash program which has efficiencies in delivery but may encounter imperfectly working food markets. The IFPRI studied in Bangladesh shows that recipients prefer a mix of cash and food suggesting that they see some problem of market failure. The advantage of rural public works is that the program is naturally self selecting towards the poor- non poor would not opt for such menial, low paid work.

In addition to self selection, works program have the advantage of encouraging increased food production by improving physical infrastructure. For that to occur, however, the food must be supplemented, normally on at

least a one to one basis with cash to purchase the essential non-labor based inputs of the works. That of course requires cash supplements to the food or equivalent cash provided to the poor that as a rule of thumb will be roughly equal to or somewhat larger than the food cost.

A second measure in rural areas, not normally practiced, but with large potential, should be special programs to increase production of the basic subsistence crops on the land operated by the poor. Because the poor do not produce enough to have net sales their agricultural production is not commercial. They derive so much income from off their farms that they are more difficult to reach with technology and they have a poor financial basis for borrowing and repaying. And so they require a specialized approach. A pro-poor agricultural production approach will require intensive extension, emphasis on low cash cost methods and requiring little or no credit. This is very different to the approach for the small commercial farmer (see below.) Therefore, extension agents might best be specialized to this function or at least have special training.

Poor resource agricultural areas have a special problem. First they tend to have crises more frequently than the better resource areas because poor agricultural resources are usually associated with low rainfall and hence

fluctuations around a mean close to the margin for covering the costs of harvest. Second, because of the poor resources they tend to have low population densities and hence poorer infrastructure and higher costs to reach the poor. Third, most families are poor. Fourth infrastructure investment is lower rate of return because of the low population densities and low productivity of agricultural resources. Relief in such areas will tend to be simply food distribution, and encouragement to migrate. Often extreme privation occurs in such areas when supply demand balances in the rest of the country have changed but little. In that case relief measures transfer largely from the poor in areas in which their poverty has not increased to the poor in areas where the increase in poverty is large. That is generally considered welfare increasing.

5.2 Global implications

The preceding discussion has profound international implications. Countries that have the resources, either domestic (because they are prosperous), or by drawing on foreign borrowing, or foreign aid will be able to protect their poor. That almost certainly requires increased imports or decreased exports, further tightening the global food situation. The more countries that have not increased domestic production sufficiently to protect

their poor from domestic production and hence the more come on the international market the higher prices will be driven and the greater the burden on the poor in remaining poor countries. In this context exporting countries that restrict exports in order to increase domestic supply are no different to importing countries that import for subsidized programs either with their own resources or with foreign aid or borrowings. Protecting the poor in both cases concentrates the burden on the poor who are not being protected. Inevitably enough poor will not be protected to equate supply and demand.

If the problem of the poor was simply one of income and not one of food supplies, then the problem stated would not exist. All that would be needed is transfer of income to the poor who would then purchase food to meet their needs. In practice, however food is limiting- that is what drove up the prices in the first place.

What countries will not be able to stay in the game? Obviously the poorest ones. In practice that is Sub-Saharan Africa and perhaps a few Asian countries such as Nepal. These countries are generally still very poor. They are highly dependent on foreign aid, especially to avert famine. And, when global prices are up, indicating a general problem, food aid, the principal

means of financing the food insecure, is sharply down because of budgetary constraints and also decreased political will in the high income aid supplying countries. Thus, shifting the burden to African countries occurs relatively easily relieving the upward pressure on food prices.

All this discussion indicates is simply that food security (and poverty) requires increased food production. Some countries may have a comparative advantage in producing non- food agricultural commodities, particularly including tropical export commodities. They can generate the purchasing power to buy food, but some countries must produce that food to export. Specializing is efficient with some countries producing a large surplus of food and others producing non-food agricultural exports to pay for food imports. But the food production increase must be there.

Where will the increased global food production occur? The high income countries do produce increasing exportable surpluses and will continue to do so at a modest and predictable rate. Those countries are at least moderately price responsive, so as prices rise they will increase exports -but at increasing privation to the poor. Perhaps the most important source of the contemporary imbalances is the retarded growth in the agriculture of the fast growth Asian countries, particularly India. Those countries have built

moderately effective agricultural technology systems and much of the institutional structure for rapid agricultural growth. In the case of India rural infrastructure is undoubtedly a major constraint.

Perhaps most important once middle income status is achieved and agriculture has declined to 20 percent or less of the GDP, it still remains the principle driver of employment growth and poverty reduction. Note the skewing of income distribution in the fast growth Asian countries in which agriculture has lagged. However agriculture is only a modest contributor to GDP growth. Egypt is an example of a middle income country which with fast growth in all sectors, agriculture with its multipliers accounts for some 60 percent of employment growth, but only 25 percent of GDP growth. It is not surprising if governments in those circumstances focus on GDP growth, and seeing the institutional complexity of accelerating agricultural growth simply opt out of those measures -although perhaps at a political cost of increasing disaffection amongst rural people in general and the rural poor specifically. However from the point of view of the global poor it is important that those rapid growth countries get back to accelerating their agricultural growth.

It is now fashionable to tout local procurement of food to meet the needs of the poor. However, if the local food supply is ample then simply providing income to the poor is an effective way to meet the problem.It is the type of situation described by Amartya Sen. If however the supply has declined locally food has to brought from outside. Perhaps there is a nearby area in which supply has increased faster than demand Then local procurement makes sense, but that is not the normal situation. Local procurement presumes that the problems not one of food supply. Normally that is not the case.

6. How to Increase Agricultural Production

Increased agricultural production in virtually all low and middle income countries comes from the small commercial farmer. That farmer has enough land to produce an above poverty level of living which means that at least half the output is sold off the farm, providing scope to finance purchased inputs and allowing specializing in production. Those poor who own land in aggregate represent half of the rural poor and a quarter of the rural population but command only 10 percent or so of the land. They are not important to the agricultural growth rate.

Production growth occurs through resource productivity increasing processes. Increasingly world markets allow specializing in high value commodities which allow large increase in incomes. Reducing cost of production through technological change is always preferred to raising prices.

However the critical distinguishing characteristic of rapid growth in agriculture is that it requires several major public goods that are not provided in the context of traditional slow growth agriculture. The small commercial farmer requires public goods because the small scale of operation does not allow the scale economies that are characteristic of the key inputs of technological change. The same is true of much of the private sector supporting farmers.

Sets of public goods are essential to rapid agricultural growth. They are stated briefly here to emphasis their public goods characteristics and the fact that a major effort is need to build the institutions on a national scale for each of these categories.

Rapid agricultural growth requires facilitative policies and as growth occurs new policy issues constantly arise. There must be an institutional

structure for set strategy, setting priorities and sequences within that strategy and providing a base for monitoring progress and making modifications.

Agriculture grows, more than any other sector on improved technology. Institutions are needed to provide a constant flow of cost reducing technology and massive extension systems are required to promulgate that knowledge. They must be linked so that the technical capacity of extension agents is constantly upgraded. As development proceeds some extension and some research will be taken over by the private sector, but even in the most developed countries the public sector is critical to agricultural growth and a complement to the growing private sector research and extension. Most countries under invest on research (IFPRI 2007, Mellor Associates 1994, Beintema et. al. 2007, Fuglie et. al. 2007, Pray et. al. 2001.)

As farmers commercialize they need increasing amounts of credit. Credit needs fluctuate greatly overtime and regions so a national system liked to global credit markets are essential. The private sector never meets these needs in early stage of development and over the long time a system developed initially under government auspices is an important part of a competitive rural finance system (Desai and Mellor 1988.) On average

farmers are net savers and so deposit mobilization is a critical part of the process.

As agriculture commercializes, physical infrastructure, of course roads, but also rural electric distribution lines increase in important (Ahmed 1987.) They are also vital to education and health (teachers and doctors live on all weather roads and commute, perhaps infrequently, to village not on such roads.)

Particularly as perishables increase in importance farmer's organizations become crucial to all farmers competing in increasingly quantity and quality conscious marketing agencies (Reardon). They are essential to rural distribution of electricity and to a competitive rural financial system. Government initially plays an important role in achieving the near national coverage required for rapid growth.

Why have I emphasized the obvious on the importance of public goods to agricultural growth? Because foreign aid donors and to some extent nationals have become so private sector oriented that they have turned away from the only rural credit systems that work for small commercial farmers (micro credit is too expensive with loans too small and cover inadequate for

this purpose) and from nationwide extension systems and to some extent even from national agricultural research systems.

Having emphasized the importance of public goods it is important to recognize that farming is a private sector business. Farmers are of course private sector. They are effectively served by a host of private enterprises, for input supply (fertilizer and pesticides), marketing of output, that are private sector and generally also relatively small. Thus they are unlikely to provide the public goods in a low income country even though in high income country such firms may be much larger and render some of the services stated here as public goods. But that comes later in the development process. The public goods must always be seen in the context of providing services to private sector enterprises.

7. Conclusions for Pakistan[1]

Pakistan has not been doing well in agricultural growth in recent years and as a result poverty reduction has more or less ceased. That is in the

[1]This section is based on several lengthy missions to Pakistan for the World Bank, Asian Development Bank, and USAID. I was fortunate to be part of a recent mission to Pakistan in November 2008 which allowed me to meet with a large number of senior academics, government officials, and private sector operatives both individually and in seminars and focus groups. Thus, this exposition represents in substantial part a consensus from those meetings.

context of lengthy past periods of rapid growth, an extraordinarily favorable natural resource base, and considerable institutional development (World Bank 2002, Government of Pakistan 2006, Punjab 2006, Punjab 2004, Punjab 2007., Naqvi et. al. 1989.) Given that record it may be useful for an outsider experienced in a wide range of countries to make some observations. I start from the position that the successful high agricultural growth countries have achieved a four to six percent growth rate in agricultural production- perhaps a doubling from the present level (Mellorl992.) I single out four areas for immediate emphasis, policy, technology, farmer organizations, and infrastructure.

To act on these priorities the government of Pakistan must be on the aggregate growth rate with small commercial farmers playing the central role and focus on the public goods and institutions essential to continuous cost reduction of both farmers and the successful private sector serving them.

7.1 Policy

Once one has a highly sophisticated agriculture as is the case for Pakistan, it is essential to have a critical mass of policy analysis focused on the agricultural sector. An institute capable of providing this needs to be

autonomous but linked to where the action is- the Ministry of Agriculture. It could benefit from integrated technical assistance to help preserve its independence, to strengthen weak areas in national capacity, and to bring in the wealth of outside experience. There are enumerable problems that require analysis.

I have the impression that there is not a clear strategy, with priorities and sequences, focused on the quantitative acceleration of the agricultural growth that is needed to guide projects that take time in institutional development and commodity growth. Much of policy and on farm decisions is commodity specific. Thus their need to be commodity priorities to guide the sequences in the development of institutional capacity much of which has substantial commodity specificity. Those priorities must be determined by the contribution to aggregate growth that is the product of the base weight of the commodity set and the expected growth rate for that commodity set

Then there are price policy problems, trade policy issues, and technical problems such as biotechnologies place (I believe Pakistan in the only major cotton exporter without a clear Bt cotton policy and hence lower yields and higher costs than competitors, hurting exports not only of cotton but also cotton products.) There is need for monitoring and evaluation of a

myriad of programs to ascertain best practices. Experience is clear that agricultural research, especially agricultural policy research does not prosper when contained in multi-purpose research institutions. It needs a specialized institute. In all the meetings I attended nothing came through more clearly than the need for and the feasibility of such an institute, and the desirability of a foreign input. That is the centerpiece recommendation that comes from such analysis. It is worth underlining the impact of such an institute on employment with a somewhat artificial calculation.

If policy is universally seen as so important and one is trying to obtain an incremental three percent points to the agricultural growth rate shouldn't one think of getting one percentage point of that from improved policy? Following the same methodology as in the country studies cited by Mellor and colleagues one estimates that would through the multipliers add one million jobs per year -providing for half of the increments to the labor force. A final comment, some in the foreign aid community believe they know the answers to all the policy problems that matter and so the problem is simply one of political will note that the World Bank and Asian Development Bank have placed huge pressure, including making funds contingent on change in policy issues with little long term effect. Pakistan's

own institutions have had some success in getting policy change (Niaz 1995.)

7.2 Technology

Pakistan has developed several research institutions for agriculture - both national and Provincial. The consensus is that they have not made steady upward progress and that they are weak on applied research, links to farmers and links for upgrading the technical competence of the extension system. Given the rapid pace of biotechnology the capacity in Pakistan has not been expanding at a rate commensurate with the long term opportunities. The extension system is considered weak but that may be due to inadequate operating budgets and to weak links to research which should link through trials on farmer's fields and upgrade extension. Foreign technical assistance would be invaluable in accelerating development of these systems.

7.3 Farmers organizations

Pakistan has considerable potential in high value commodities - livestock and horticulture indeed the bulk of the acceleration in the agricultural growth rate will be in these commodities. For the small farmer to

compete, particularly as super markets make the inevitable entry to dominate retailing in Pakistan, farmers must be organized. It is essential for rural electrification distribution. systems. That would also help in the credit markets. Pakistan has a good start in the RSP, but much more needs to be done in the new context.

7.4 Infrastructure

Is there a plan to place every village on an all weather road with electrification? A country such as Pakistan needs that. With a high growth rate so dependent on high value commodities that tend to be perishable roads and electrification are essential (Ahmed 1987.)

8. Conclusion

The contemporary shifting of demand for food more rapidly than supply and consequent upward pressure on prices is hugely deleterious to the poor. As in almost all food insecurity situations this one can only be solved in terms of the global aggregates by substantial increase in the rate of growth of agricultural production. The countries experiencing the rapid growth in demand must play a major part in this process- most have been lagging in

agricultural growth over the past few decades. The principle bottleneck to increased supply is the set of public goods - policy analysis, technology, credit, farmer's organizations, and infrastructure- all of which are essential complements to private sector farmers and the businesses serving them. Governments must of course leave the donor fad of favoring small unrelated projects, for focus on the aggregate growth and the national institutional capacity essential to that growth.

Individual countries may of course protect their poor by various programs that ensure their supply of food. However those programs require increasing the total supply of food either through export restrictions or import. Those measures then shift the burden to the poor of countries lacking full coverage of such programs. Those will be the poorest countries, lacking their own resources and dependent on donors of food aid whose supplies become small with the rise in prices. Those countries are largely in and dominate sub-Saharan Africa.

As individual countries understandably try to protect their own poor, optimal programs differ between urban and rural areas. In urban areas there is a wealth of analysis that clarifies how urban distribution programs may be most efficient in targeting the poor. Those programs involve some sort of

rationing and price reduction for the poor. It is important that such programs not widen urban rural income disparities, thereby inefficiently increasing the migration to cities with a consequent loss of efficiency.

For rural areas guaranteed employment schemes are self selecting towards the poor and help solve the supply problem by creating roads and other productive infrastructure. Unfortunately lack of prior planning minimizes the extent to which such programs are utilized, particularly by the international agencies that supply so much of the food aid. Prior planning is needed to have standby programs ready to go. For the regular suppliers and users of food aid it is unconscionable that such planning has not occurred.

The second program for rural areas, rarely practiced, would be to develop specialized programs to double the yields on the subsistence farms that are populated largely by the poor. On average those with farms too small to produce half the poverty level of income produce half their income from farming. They could achieve a 50 percent increase in real income through such a program.

9. References

Ahluwalia, M.S.1978. "Rural Poverty and Agricultural Performance in India." Journal of Development Studies 14: 298-323.

Ahmad, Munir and Sarfaraz Khan Qureshi. 1999. "Recent Evidence on Farm Size and Land Productivity: Implications for Public Policy", The Pakistan Development Review 38(4) (1999),:1135-1153.

Ahmed, Raisuddin 1987, Rural Infrastructure, IFPRI, Washington

Barrios, Jose Miguel, and John W. Mellor (2006), Agriculture and Employment Growth in Guatemala, IARNA, Guatemala

Bell, C. L., P. B. Hazell, and R. Slade. 1982. Project Evaluation in Regional Perspective: A Study of an Irrigation Project in Northwest Malaysia. Baltimore: Johns Hopkins University Press.

Bhalla, S. 2004. "A perspective on Employment in India's Non-farm Sector." Paper for the National Commission on Farmers, Jawarlal Nehru University, Delhi.

Beintema, Nienke M., Waqar Malik, Muhammad Sharif, Gert-Jan Stads, and Usman Mustafa. 2007. Agricultural Research and Development in Pakistan: Policy, Investments, and Institutional Profile. International Food Policy Research Institute and Pakistan Agricultural Research Council.

Bouis, H. 1999. Patterns of Food Consumption and Nutrition in Egypt. IFPRUFSR- APRP, Ministry of Trade and Supply, Government of Egypt.

Delgado, C., C. Hopkins and V. Kelly.1998. Agricultural Growth Linkages in Sub- Saharan Africa. International Food Policy Research Institute, Washington D. C., Research Report No. 107.

Denninger, Klaus and Lyn Squire 1998. "New Ways of Looking at Old Issues", Journal of Development Economics, 57 (2)

Fan, S., C. Chan-Kang and A. Mukherjee. 2005. "Rural and Urban Dynamics and Poverty," Evidence from China and India." DSGD Discussion Paper 23, FCND Discussion Paper 196, International Food Policy Research Institute, Washington D.C.

____. L. Zhang and X. Zhang. 2002. Growth, Inequality, and Poverty In Rural China. Research Report 125, International Food Policy Research Institute, Washington, D.C.

Fuglie, Keith 0. and Paul W. Heisey. 2007. Economic Returns to Public Agricultural Research United States Department of Agriculture, Economic Brief Number 10.

Gavian, S., T. El-Meehy, L. Bulbul, G. Ender. 2002."The Importance of Agricultural Growth to SME Development and Rural Employment in Egypt." MVE Unit, APRP, Special Study No.5, Abt Associates Bethesda, Maryland

Government of Pakistan. Agricultural Statistics of Pakistan (2005-2006).

Haggblade, Steven, P.B.R. Hazell and Thomas Reardon, eds. 2008, Transforming the Rural Nonfarm Economy. International Food Policy Research Institute, Washington D.C.

_____and P.B.R. Hazell. 1989. "Agricultural Technology and Farm-nonfarm Growth Linkages." Agricultural Economics 3:345-364.

_____]·Hammer and P.B.R. Hazell. 1991. "Modeling Agricultural Growth Multipliers", American Journal of Agricultural Economics 73: 361-374

Hazell, P. B.R. and C. Ramasamy. 1991.The Green Revolution Reconsidered-- The Impact of High Yielding Varieties in South India. John Hopkins University Press, Baltimore

_____and A. Roell. 1983. Rural Growth Linkages: Household Expenditures Patterns in Malaysia and Nigeria. Research Report No. 41, International Food Policy Research Institute, Washington D.C.

Hossain, Mahboob (1987).The Grameen Bank, International Food Policy Research Institute Research Report, Washington

International Food Policy Research Institute, and Pakistan Agricultural Research Council. 2007. Agricultural Research and Development in Pakistan: Policy, Investments, and Institutional Profile.

Johnston, B. F. and P. Kilby. 1975. Agricultural and Structural Transformation: Economic Strategies in Late-Developing Countries. Oxford University Press, Oxford

Johnston, B. F. and J. W. Mellor. 1961"The Role of Agriculture in Economic Development", American Economic Review. 51: 566-93.

Lee, T. H. 1977. Intersectoral Capital Flows in the Economic Development of Taiwan, 1895-1960. Ithaca:Cornell University Press.

Lele, U. J. and J. W. Mellor. 1981. "Technological Change, Distribution Bias and Labor Transfer in a Two-Sector Economy." Oxford Economic Papers, 33: 426-441.

Lewis, A. 1954. "Economic Development with Unlimited Supplies of Labor, Manchester School of Economics and Social Studies, 22: 139-181.

Liedholm, C. and D. Meade, 1987. "Small Scale Industries in Developing Countries: Empirical Evidence and Policy Implications." International Development Papers, Department of Agricultural Economics, Michigan State University, East Lansing.

Mead, D.C. and C. Liedholm:1998. "The Dynamics ofMicro and Small Enterprises in Developing Countries." World Development. 26: 61-74.

Mellor, J. W. 1976. The New Economics of Growth. Cornell University Press, Ithaca, NY,

_____1978. "Food Price Policy and Income Distribution in Low-Income Countries." Economic Development and Cultural Change. 27: 1-26.

_____ 2002. "How Much Employment Can Rapid Agricultural Growth Generate? -Sectoral Policies for Maximum Impact in Rwanda." Agricultural Policy Development Project, Research Report No. 13, Abt Associates, Inc. Bethesda, MD.

_____1992. Agriculture on the Road to Industrialization. Johns Hopkins University Press: Baltimore.

____ and G. M. Desai.1985. Agricultural Change and Rural Poverty. Johns Hopkins University Press: Baltimore.

_____and S. Gavian. 1999. Determinants of Employment Growth in Egypt: The Dominant Role of Agriculture.and the Small Scale Sector. Impact Assessment Report No. 7, Abt Associates, Bethesda, MD.

_____and U. J. Lele. 1973. "Growth Linkages ofNew Foodgrain Technologies." Indian Journal AgriculturaL Economics. 28 (1): 35-55.

_____and C. Ranade. 2006. "Why Does Agricultural Growth Dominate Poverty Reduction in Low and Middle Income Countries?", Pakistan Development Review

and M.. Usman 2006, Agricultural Growth for Building Afghanistan as a Strong Regional Partner, Regional Donor Conference on Afghanistan, New Delhi, November 2006

Mellor Associates. 1994. Institutional Reforms to Accelerate Irrigated Agriculture. Volumes I and II. Washington, DC.

Naqvi, Syed Nawab Haider, Mehmood Hasan Khan and M. Ghaffar Chaudhry. 1989. "Structural Changes in Pakistan's Agriculture." PIDE, Islamabad, Pakistan.

Niaz, M. Shafi. 1995. Pricing of Farm Produce in Pakistan. Print Associates International, Islamabad.

Pray, Carl E. and Keith Fuglie (with contributions from Joseph G. Nagy, Mumtaz Ahmad.and Rakesh Basant). 2001. Private Investment in Agricultural Research and International Technology Transfer in Asia. United States Department of Agriculture, Agricultural economic report No. 085.

Punjab Economic Research Institute 2007. "Punjab Economic Report 2007."

_____2004. Accelerating Agricultural Growth in the Punjab. Priorities for Public Policy.

Rangarajan, C. 1982. Agricultural Growth and Industrial Performance in India. Research Report 33, International food Policy Research Institute, Washington, D.C.

Rao, C.H.H. 1975. Technological Change and Distribution of Gains in Indian Agriculture. Macmillan: Delhi.

Ravallion, M.and G. Datt. 2002. "Why Has Economic Growth Been More Pro-Poor in Some States oflndia than Others?" Journal of Development Economics. 68: 381-400. Rwanda, Republic of.2000. Rwanda Development Indicators. July, No.3 Ministry of Finance and Economic Development, Department of Statistics

_____and Huppi 1991, "Changes in Poverty," World Bank Economic Review, 5

Ryan, Joe, and Shaheen Rafi Khan. 1992. "The Impact of GOP's Wheat Pricing Policy on Flour Prices." USAID.

Sen, Amartya. 1983. Poverty and Famines, Oxford University Press, London

Thirtle, C. 2001. "Relationship Between Changes in Agricultural Productivity and the Incidence of Poverty in Developing Countries". DIVD Report No. 7946, London.

Timmer, C. P. 1997. "How Well do the Poor Connect to the Growth Process?" CAER Discussion Paper No. 178, Harvard Institute for International Development, Cambridge.

United Nations Development Programme. The UN Inter Agency Assessment Mission. 2008. High Food Prices in Pakistan. Impact Assessment and the Way Forward.

_____2002. Poverty in Pakistan: vulnerabilities, social gaps and rural dynamics, Report No. 24296-PAK.

II. THE IMPACT OF INFORMAL ECONOMY WITH SPECIFIC REFERENCE TO AGRICULTURE POLICY ISSUES

By

Mussadaq Mohammad Khan, Chairman, API

1. Abstract

The article deals with the informal economy of the country. It points out informal economy areas where the government should intervene and collect revenue by converting the activity into formal economy. This step ultimately will increase the tax to GDP ratio which is on the lower side.

2. Introduction

i) The purpose of writing this article is to highlight the main issues, effecting the income of farmers. It draws a framework in qualitative terms to bring the informal sector, into a formal regime, to generate revenue.

ii) To begin with wheat crop; it covers about 9 million hectares area and produces 24 million tonnes wheat. The stocks available with Pakistan Agricultural Storage & Supplies Corporation (PASSCO), the provincial governments and the private sector comes to over 5 million tonnes. Since Pakistan has a porous borders; it is mostly smuggled to Afghanistan, Indian held Kashmir. It also goes to the Rajistan (India) because of very high prices. It may be taken into

consideration, that the milled wheat also travels upto Central Asian Republics through North of Afghanistan. Resultantly, this informal sector through exchange of goods, such as spices, beef and other minor crop produce enters Pakistan. The main reason is price determination for which the stock holders in the private sector benefit. Since they act in a zero rated regime, the public agencies over the past, could not deal with this across border inflows and outflows of goods and services. Ostensibly, it is due to lack of facilitation provided to the informal sector, into the tax base, with very nominal export taxes. The remedy can be to allow exports and provide them with some fiscal incentive at the time of dispatch of goods. The same applies to rice and cotton, ready made garments and knitwear. Sugarcane however is confined to sugar products and cane sugar and that too comes under informal regime. As far as tobacco in concerned the Afghan market looks for low priced brands, and in turn dispatch branded European, American and Japanees brands. In Kabul, I have witnessed local stores of our utility store.

3. Informal Trade from Sindh and Northern Areas

From Karachi side informal trade takes place through sea routs to Dubai and Arab States and through cross border informal trade with India. Launches usually are used to transport vegetables like potato, onion etc. to Dubai. The land trade with India is usually of dry dates which are used in religious rights of Hindus. Pakistan receives cows

and buffaloes in return. Similarly on Northern side of Pakistan a narrow border with Russia exists on high mountains where wheat trade takes place and in return USSR people send Marco Polo sheep.

4. Wheat Informal Trade

Wheat informal trade is a regular feature of Pak Afghan Boarder. Afghanistan is generally food deficit country. Afghans consume Pakistani wheat weather they are living in their own country or staying in Pakistan as migrant. Although Pakistan has very stringent security measures at boarder. In the presence, Military, Para-military, Rangers, Scouts, Border Security Force wheat smuggling is a usual phenomena because vehicles provide illegal gratification to the concerned staff serving over there and the vehicle passes every hurdle to reach the planned destination.

5. Informal Domestic Economy

Cottage industry having a few on job workers are located in the out skirts of big and small cities. They are not registered and they do not pay any tax or revenue to the government. These small industries generally include shoe making, gur making, garment stitching and embroidery, clay utensils, card board making etc. Their workers are generally low paid and they don't fallow government regulations and provide old age benefits and medical facilities to their staff etc.

6. Afghan Transit Trade

Afghanistan is land locked country. It has no sea port. Government of Pakistan has facilitated their imports through Karachi port. Imported consignments reach Kabul via road link from Karachi to Afghan boarder. Imported items are consumables ranging from edibles, garments, electronic items, crockery, toys and many more. If we have a close look to the Afghan population. It is war hit population and war hit economy. It is very difficult for a large portion of population to live beyond basic necessities of life. For a population who can not make either its livelihood properly. How can it think of luxuries and comforts of life on regular basis? The fact of the matter is that certain strong businessmen comprising of both Afghans and Pakistani's are involved in these luxurious imports. The imports are made through the facility of Afghan Transit Trade. The imported items seldom remain in country of import they just cross the boarder. These items are frequently available in Bara markets of Pakistan. Most important is Hyatabad market in Peshawar. So frequent is the trade that Bara markets are now spread all over the big cities of Pakistan. Government should have second thought and reconsider the Afghan transit trade agreement. The items under the agreement should be closely restricted so that the agreement should not hit our trade and our economy should not be deprived of the revenue through this mal-practice.

7. Informal Trade in Balochistan

i) Balochistan shares it boarders with Afghanistan and Iran. From the Afghan boarder trade of Sunder Khani Grapes, Qandahre Pomegranate and other dry fruits is made through Chaman area. Wheat and wheat straw are the major source of smuggling to Afghanistan. Usually there is dearth of wheat straw in Balochistan as it is frequently smuggled from there to the interior of the neighbouring country. Smuggling of fertilizer has also been reported.

ii) Iran has imposed heavy duty on import of rice. To get rid of the heavy import duty exporters of rice from Pakistan easily adopt informal channels to export rice to Iran. Carpets, garments, edibles and petrol are usually smuggled from Iran. Quetta market is flooded with these items.

8. Gur Making and its Trade in KPK

KPK is an important sugarcane producing province having sugar industry which absorbs its supplies. But gur making in the province is on the rise which deprives industry from its raw material. Gur making is a profitable business as gur sells higher than price of sugar. Gur is smuggled frequently to Afghanistan and on ward neighbouring states. Where it is used for making alcohol and other edible uses. This trade deprives government from its revenue.

9. Required Intervention/Conclusion

i) Once Dr. Mehbob-ul-Haq Ex-Finance Minister of Pakistan estimated that the size of informal economy is at least of the size of GDP. Since then informal economy has expanded to alarming proportions. The tax collection in the country is not upto the mark which is evident from the fact that the tax to GDP ratio is only 50 percent than that of tax to GDP ratio in India.

ii) The tax collecting arm of the government should have a clear cut strategy to cope with informal economy.

iii) The Government without delay must focus on this aspect for bringing the informal sector into the formal sector, with a minimum front loading.

III. IMPACT OF AGRICULTURE POLICIES ON YIELD OF CROPS: PAK PUNJAB VS INDIAN PUNJAB

By

Masood Bakhtiar Siddiqui, Chief, API

1. Abstract

Comparison of Crop Yields in Pak Punjab and Indian Punjab highlights significantly higher yields of food grains in Indian Punjab. Agriculture Policies in two segments of Punjab indicate that in Punjab (Pakistan) imposition of RGST on agriculture inputs and implements may be withdrawn. Moreover fertilizer and electricity for tubewells may be further subsidized. Greater subvention may be provided in Agriculture Credit and Agriculture Insurance be developed on scientific lines

2. Introduction

Punjab was one of the agrarian provinces in British India. Partition of the sub-continent took place in 1947 and Pakistan and India came into being. Punjab province was divided between India and Pakistan according to an agreed distribution plan. The geographical area of the Punjab was about 26 million hectares of which 21 million hectares were allocated to Pakistan and 5 million hectares to India. Meaning thereby that in the distribution of Punjab, the share of Pakistan was 80 percent, and that of India was 20 percent.

The significance of agricultural development in the two parts of Punjab is of paramount importance in the food security of the two countries. The land of the province is fertile having most developed canal irrigation system. The irrigation system is supplemented by tube wells and widespread rains during the rainy season.

Indian Punjab encompasses only 1.5 percent geographical area and 3 percent of its cropped area. Its share in cereal production is 13 per cent. Its cereal productively is 4 tonnes/ha which is almost double than that of country level productivity of cereals. About 85 percent of the geographical area of Punjab is farmed compared to 46 percent of the country as a whole. Rice and wheat are major cereal crops of the province which occupy about 95 percent of the irrigated area.

The part of Punjab available with Pakistan shares 76 percent area of the country and 71 percent of the cropped area. Punjab's share in cereal production stands at 73 percent. Cereal productivity in Punjab is 2.54 tonnes/ha which is marginally up by 0.07 tonnes/ha when compared with country level productivity. Wheat and rice occupy about 50 percent irrigated area. Farming occupies 60 percent area of the province.

Salient features of agriculture of the two Punjabs are placed in Table-1. These include geographical area, farming area, cropped area, net area sown and irrigated. Wheat, rice, cereals and food grains area. The yield data given in the table also refers to these crops.

Table-1 indicates that farming area and cropping intensity far exceeds in two parts of Punjab. Moreover, there is marked difference between the yields of

Table-1: Comparison of Agriculture Parameters: Pakistani and Indian Punjab

Parameters	**Pak Punjab**	**Indian Punjab**
	Million hectares	
Geographical area	20.63	5.04
Net area sown	10.98	4.24
Cropped area	16.73	8.07
Net irrigated area	14.57	4.04
Cropping Intensity (%)	152	190
Farming area (%)	60	85
Wheat area	3.08	3.47
Rice area	1.78	2.64
Cereals area	9.24	6.28
Food grains area	10.42	6.35
Yields	**Kgs/hectare**	
Wheat	2775	4179
Rice	1779	3858
Cereals	2537	4003
Food grains	2335	3700

Note: All Statistics relate to 2006-07.

Source: Agriculture Statistics of Pakistan and India.

wheat, rice, cereals and food grains. Here we have the opportunity to go through agriculture policies being followed in two segments of Punjab which have resulted in significant difference in per hectare yield of various crops. Both input and output policies have their due role in elevating yields.

3. Fertilizer

Balanced use of fertilizer is instrumental in raising crop yields. Proper soil testing and applying doses of fertilizers on the basis of soil testing improves yield of crops per unit of land. Generally the recommended ratio of N, P and K is 4:2:1. From this norm we can estimate the balanced use of fertilizer over time and space. An indicator of imbalance is given by the equation (Mehta 2007).

$$I = [\{(N_a-N_n)^2 + (P_a-P_n)^2 + (K_a-K_n)^2\}/3]^{0.5}$$

Where

I = Measures of deviation from the norms

a = Subscript 'a' stands for actual and

n = Subscript 'n' stands for norm

If the N, P and K are used in the recommended ratio then I = 0. If the entire amount of fertilizer is in the form of K then I = 0.49. Meaning thereby 0 means perfect balance and 49 percent means extreme imbalance.

Fertilizer consumption separately for nitrogen, phosphate and potash for Punjab (India), and Punjab (Pakistan) are placed in Table-2. An indicator of imbalance has been calculated for each of these regions. This table provides us a complete picture of fertilizer use efficiency/inefficiency between two Punjabs.

The comparison of fertilizer use per hectare brings to fore that over all and nutrient specific fertilizer use in India is more than in Pakistan. India (Punjab) consumes 47 percent more fertilizer. As far as balanced use of fertilizer is concern Indian application is close to balanced use while in Pakistan (Punjab) it approaches to extreme side of imbalance.

Table-2: Fertilizer Consumption

Nutrients	Punjab(India)	Punjab (Pakistan)
	------- 000 tonnes -------	
Nitrogen	1299	1785
Phosphate	353	684
Potash	39	31
Total	1691	2500
	------- Kgs/ha -------	
Nitrogen	161	107
Phosphate	44	41
Potash	15	2
Total	220	150
Consumption ratio	11:3:1	54:21:1
Index of imbalance	3.9	30.5

Source: Agricultural Statistics of Pakistan and India.

A close positive association exists world wide between level of fertilizer application and crop productivity. For example the overall rate of N+P+K application in India (Punjab) is 47 percent higher than Pakistan (Punjab) and the wheat yield in India is also 51 percent higher than in Pakistan (4179 kg/ha vs 2775 kg/ha). For cereals as a whole it is 58 percent higher than in Pakistan (4003 kg/ha vs 2537 kg/ha).

In India comparison of three Northern States (Behar, Punjab and Uttar Pradesh) with fairly similar soil and climatic conditions brings to fore close association between the level of fertilizer use and crop yields. In case of cereals yield in Behar and UP is 43 and 63 percent that of Punjab and the average rate of

fertilizer consumption in Behar and UP as a percentage of Punjab is also close to yield gap i.e. 46 percent and 66 percent, respectively.

Adequate and balanced use of fertilizer which is strongly associated with crop yields is dependent upon a lot of factors. Urea (Rs 508) and DAP (Rs 1148) fertilizer prices are highly subsidized in India while in Pakistan urea prices have increased by 120 percent and that of DAP by 240 percent (Annex-1). Both countries subsidize fertilizer to promote its use. The average per hectare fertilizer subsidy in India and Pakistan during the last five years is Rs 3403 and Rs 896 respectively. Meaning thereby that Pakistani farmer is receiving only about a quarter of the subsidy what the Indian farmer is getting (Annex-II). In the budget 2011-12 government of Pakistan has imposed 16 percent Reform General Sales Tax (RGST) on fertilizers, pesticides and agriculture implements which were previously duty free. This would further detoriate the relationship between yields of crop and fertilizer application.

In the Standing Committee Meetings of Agriculture Policy Institute the grower members of the Committee express their serious reservations over short supply of fertilizers during sowing and growth period of crops. Black marketing of fertilizers, under weighment and other malpractices in fertilizer trade are hampering crop sector. The wrong doing in the fertilizer sector be checked and soil testing be popularized before application of fertilizer to pickup the yield level of crops.

Response rates needed for a value cost ratio (VCR) of 3 for wheat in India and Pakistan at current input and output prices are given in Table-3.

Table-3: Economic Returns from Fertilizer Use at Current Input and Output Prices

Country	Kgs of wheat needed to pay for 1 kg		Response rate needed for VCR of 3	
	N	P	N	P
India	1.05	1.62	3.15	4.81
Pakistan	1.36	4.28	4.08	12.84

Sources: 1. Fertilizer Review NDFC 2010.

2. Agricultural Statistics of India.

The response rate needed to have a VCR of 3 far exceeds in case of Punjab (Pakistan). In case of phosphatic fertilizers it is about three times high. This situation simply reflects how much privileged the Indian farmer is as compared to Pakistani farmer as he is receiving much needed fertilizer subsidy at a higher rate. The imposition of RGST on fertilizer would further worsen the relationship for Pakistani farmer.

4. Agriculture Credit

Credit is the life line of agriculture. Farmer takes credit for the cultivation of crops, pays it back after harvesting them. He again takes credit for the husbandry of next crop and pays it back after selling the mature crop. The system continues, agriculture progresses and the government through provision of institutional credit plays an important role in sustaining agriculture.

In Pakistan ZTBL, five Commercial Banks, Fourteen designated Private Banks and PPCBL extend agriculture credit to the farming sector. ZTBL provides subvention in credit interest while the other banks charge the market rate. ZTBL's interest rate is from 8 to 9 percent. Pakistan Credit Advisory Committee (PCAC) of State Bank of Pakistan sets, monitors and evaluates agriculture credit disbursement.

In India agriculture credit is disbursed through four main sources which include Cooperatives, State Governments, Scheduled Commercial Banks (SCB) and Regional Rural Banks (RRB). They have variety of agriculture credit schemes including collateral free credit. Under this scheme credit is disbursed to farmers group and each one of them is held responsible for the repayment. They also have Kissan Credit Card scheme as well. The interest rate on agricultural loans ranges from 8 to 9 percent. Average short term interest rate is around 6 percent.

The comparison of credit disbursement per cropped hectare is placed in Table-4.

Table-4: Disbursement of Agriculture Credit per Hectare: 2005-06 to 2009-10

Year	Pakistan	India	Pak credit as percent of Indian credit
	Rs/cropped hectare		
2005-06	6519	10100	65
2006-07	10091	13700	74
2007-08	12474	15800	79
2008-09	13739	17320	79
2009-10	14630	-	
Average (2005-06 to 2008-09)	**10706**	**14230**	**75**

Source: Calculated from Economic Surveys of Pakistan and India.

Table-4 mentions that on average Pakistani farmer is getting only 75 percent of Institutional credit what his Indian counter part is getting on cropped hectare basis that too on higher interest rate. In Pakistan the situation has improved over time as the disbursement per hectare has increased from 65 to 79 percent during last five years. The share of ZTBL in total institutional credit may be kept at 50 percent for the benefit of the farming community.

5. Irrigation

Both parts of Punjab enjoy world's largest canal irrigation system facility. In Pakistan Indus and its distributaries ~~supply~~ surface water at an historic average of 104 MAF per annum through 40000 mile long canals and 130000 water courses. Annual water requirement at canal head could range from 135-170 MAF. Existing irrigations mechanism has reportedly working on 40-45 percent efficiency.

Irrigation water charges were introduced in the subcontinent in 1873. From then on they are being revised and updated over time and space. Farmers receiving water from publically built projects rarely pay more than 20 percent of water real cost and often much less. According to one estimate the irrigation subsidies on a world wide basis are $ 33 billion per year. If full cost of environmental damage, human resettlement from dam cites and increased water born diseases from

irrigation projects were factored in, the total subsidy would be much higher. Prevalent crop specific canal water rates are given in Table-5.

Table-5: Water Rates (Rs/Acre)

Crop	Punjab	Sindh
Wheat	50	53.30
Rice	85	88.78
Cotton	85	93.09
Sugarcane	250	181.87

Source: Agriculture Policy Analysis Papers for respective crops.

Electricity charges for agriculture tubewells are Rs 5.31 per unit in Punjab (Pak) while in Indian Punjab electricity is provided free of cost to the agriculture tubewells. In other provinces it is charged @ 20% of the operating cost. In Pakistan sales tax would be levied on electricity bills for tubewells. The overall per unit rate for agriculture tubewells would work out Rs 6.16. According to estimate the imposition of sales tax on tubewells bills would cost Rs 6 billion additionally to the farming community in Pakistan.

6. Agriculture Insurance

The need to protect farmers from agriculture variability has been continuing concern of agriculture policy. In both India and Pakistan Agriculture Insurance instruments are being used in different forms. India has experienced following agriculture schemes.

1. First Individual Approach Scheme 1972-78
2. Pilot Crop Insurance Scheme 1979-84 (PCIS)
3. Comprehensive Crop Insurance Scheme 1985-99 (CCIS)
4. National Agriculture Insurance Scheme 1999-todate (NAIS)

The premium rates under NAIS applicable on sum insured are as given in Table-6 below:

Table-6: Premium Rates of Different Crops in India

Crop	Premium (%)
Wheat	1.5
Other Rabi Crops	2.0
Bajra, Oil seed	3.5
Other Kharif Crops	2.5

Source: State Bank Task Force on Agriculture Insurance.

In Pakistan Crop Insurance Scheme is still in development stage. ADBP and SBP has made some efforts on Pilot Project basis. In the recent past Crop Loan Insurance Scheme was in operation. Under the scheme the maximum sum insured was Rs 2.0 million and amount of premium was 2% plus applicable levies. The scheme was applicable to loanee farmers only. The premium of small farmers upto 12.5 acres of land was to be paid by the government. Later on this scheme was extended to the agriculture sector as a whole with generalized 2 percent premium.

Agriculture Insurance in Pakistan is still in infancy in Pakistan.

7. Tractor and Diesel

Tractor is instrumental in farm mechanization and stable prices of diesel play an important role in keeping cost of production of crops at moderate level.

In India tractor prices range between Rs 0.35 million to Rs 0.5 million depending upon horse power. These prices in Pakistani Rupees work out to Rs 0.659 million to 0.941 million. Prices of locally manufactured tractors in Pakistan range between Rs 0.58 million to Rs 1.55 million Annex-III.

An average Indian tractor costs about Rs 0.8 million. Prima facia it appears that price of Indian tractor is about 10 percent higher than Pakistani tractor. Depreciation of Pakistani Rupee as compared to Indian Rupee may be one of the factors as one Indian Rupee is equal to Pak Rs 1.882. However, after imposition of RGST prices of Pakistani tractors would be higher to the tune of 5 percent.

Cost of diesel per litre in India is Rs 37.75 (Pak Rs 71.05). While in Pakistan it is Pak Rs 92.30 i.e. about 30 percent higher than in India. This difference significantly adds to cost of production of crops. In case of wheat tractor operation charges in total cost of production work out to 12 percent. The overall impact on cost of production of wheat works out to 4 percent.

8. Seed

Policy Changes in Agriculture and technological innovations in seed in shaping growth of material plays a vital role in realizing the yield potential of any crop.

In Pakistan Public Sector is taking care off of all the crops of interest for which certified/improved seed is required. The sector usually work on 20 percent of total seed requirement of crops of interest including wheat, gram, maize, rice, cotton etc. Private Seed Companies are registered under FSC&RD. Distribution of seed in Pakistan in 2011 is given in Table-7.

Table-7: Distribution of Certified Seed in Pakistan: 2011

Crop	Local	Imported	Total
Wheat	347.9	-	347.9
Cotton	7.2	-	7.2
Paddy	25.6	3.9	29.5
Maize	1.5	4.6	6.1
Pulses	1.1	-	1.1
Oilseeds	0.1	0.6	0.7
Fodders	0.01	4.0	4.0
Vegetables	0.3	5.2	5.5
Potato	0.1	4.2	4.4
Total	383.9	22.6	406.5

Source: Federal Seed Certification and Registration Department, Pakistan.

In India public sector meets the seed need of large sections of farmers particularly for self pollinated crops, the private seed companies are supplying in increasing proportion of hybrid seed (Table-8).

Table-8: Distribution of Certified Seed in India

Year	Production of breeder seed	Production of foundation seed	Distribution of certified seed
	---------- 000 tonnes ----------		
2005-06	6.864	74.0	1267.5
2006-07	7.383	79.6	1550.1
2007-08	8.008	85.0	1620.0

Source: Agricultural Statistics of India.

9. Support Prices of Wheat

Both India and Pakistan has a long history of providing support to domestic farmers by announcing support prices. Wheat support prices both in Pakistan and India from 2005-06 to 2009-10 are given in Table-9.

Table-9: Support Prices of Wheat in Pakistan and India: 2005-06 to 2009-10

Year	Pakistan	India	Increase/Decrease in India price (%)
2005-06	415	348	-16
2006-07	425	412	-3
2007-08	625	617	-1
2008-09	950	711	-25
2009-10	950	792	-17

Source: Economic Survey of Pakistan and India.

Wheat support prices in India on an average are 14 percent less. This is so because input prices in India are highly subsidized. Higher support prices in Pakistan improved wheat production and stocks. As the prices in the neighbouring countries i.e. India and Afghanistan were low which has discouraged smuggling of wheat from Pakistan.

10. Conclusions

The analysis brings to fore that suitable policies to improve yield of crops to have sustainable food security in Pakistan are required. These include:

i) Popularize soil testing to have optimum benefit of fertilizer application.
ii) Provision of subsidies to Nitrogenous, Potassic and Phosphatic fertilizers to provide their balanced use.
iii) Fertilizer, other agriculture inputs and implements be exempted from RGST.
iv) Significant reduction in the charges of electricity for agricultural tubewells be made.
v) Institutional credit for agriculture may be enhanced and ZTBL's share in agriculture credit may be maintained at 50 percent which is currently hovering around 30 percent.
vi) Agriculture Insurance may be developed on scientific grounds.
vii) Provision of certified/improved seed be enhanced.

11. Bibliography

1. Agricultural Statistics of Pakistan
2. Economic Survey of Pakistan
3. Agricultural Statistics of India
4. Economic Survey of India
5. Indian Punjab Agriculture, Farming outlook 2008
6. National Food Security vis-à-vis sustainability of agriculture in high crop productivity. Current Science vol 98 No.1, 10 January 2010
7. Policy Brief and Progress in Agriculture Insurance in India, National Centre for Agriculture Economics and Policy Research.
8. The Seed Bill 2010 – A critical Approach NCAP, India
9. Fertilizer Growth, Imbalances and Subsidies Trends and Implications, NCAP, India
10. Fertilizer Review 2009-10, NFDC, Pakistan.

Annex-I

Prices of Urea and DAP in Pakistan: 2000-01 to 2009-10

Year	Urea	DAP
	Rs/bag of 50 kg	
2000-01	363	669
2001-02	394	710
2002-03	411	765
2003-04	421	913
2004-05	468	1001
2005-06	509	1079
2006-07	527	993
2007-08	581	1931
2008-09	751	2578
2009-10	800	2267

Source: Agricultural Statistics of Pakistan: 2009-10

Annex-II

Subsidy per Crop Hectare in India and Pakistan: 2005-06 to 2009-10

Year	Subsidy (Pak Rs/ha)		Pak subsidy as percent of Indian subsidy
	India	Pakistan	
2005-06	1280	346	27
2006-07	1865	726	39
2007-08	2558	860	34
2008-09	6442	1714	27
2009-10	4868	834	17
Average	3403	896	26

Source: Economic Survey of Pakistan and India.

Annex-III

Prices of Locally Manufactured Tractors: 2011

Tractors Model (Horse Power)	Price/Unit (Rs)
NH/FIAT- 480S (55 HP)	579,735
NH/FIAT-GHAZI (65 HP)	655,200
NH/FIAT 640 (75 HP)	840,060
NH/FIAT 640S (85 HP)	930,150
NH 55-56 (55 HP)	661,050
NH 60-56 (60 HP)	725,400
MF240 (50 HP)	630,630
MF 260 (60 HP)	700,830
MF 350 (50 HP)	665,730
MF 375S (75 HP)	958,230
MF 385 (85 HP)	1,058,850
MF 385 (4WD) (85 HP)	1,550,250
Universal- 530 (55 HP)	607,230
Universal- 530 (55 HP) Plus	654,030
Universal-533 (55 HP) Plus	654,030
Universal 640 (65 HP)	829,530
Universal 683 (83 HP)	923,130
JD-5055 B (55 HP)	643,500
JD-720 (72 HP)	789,750

Source: Economic Survey of Pakistan: 2010-11.

IV. THE DEVELOPMENTAL IMPACT OF AGRICULTURAL SUBSIDIES?

By

Sohail Mohammad Khan, Chief, API

1. Abstract

EU and US are providing generous agriculture subsidies to their farmers. There farm products are dumped in the developing countries below production cost. This situation is detrimental to the farmers of the developing countries. The study proposes Food Security base in the WTO agreement on agriculture to enable developing countries to protect their farmers and crops.

2. Introduction

An agricultural subsidy is a governmental subsidy paid to farmers and agribusinesses to supplement their income, manage the supply of agricultural commodities, and influence the cost and supply of such commodities. Agricultural subsidies have the direct effect of transferring income from the general tax payers to farm owners. The justification for this transfer and its effects are complex and often controversial. Many developed and developing countries are providing subsidies to their farmers not only to protect them from outside competition but also to promote agriculture growth. Their open objectives of providing subsidies are (a) to undermine the livelihoods of poor and small-scale farmers (b) to encourage over-production, to distort trade and depress prices (c) to make US and EU farm goods artificially competitive in the world markets (d) to dump cheap subsidized produces in poor countries.

The European Union and United States are increasing the gap between rich and poor by using farm subsidies. At the end of the 20th Century, countries belonging to the OECD subsidized and supported their farmers to the tune of $300 billion a year (1999-2001 average), compared with an average of $302 billion in 1986-88. The level of support to farmers in the OECD countries is now roughly equivalent to the gross national product of the whole of sub-Saharan Africa. Their level of subsidies is six times the total amount of aid to developing countries. That's enough to feed, cloth, educate and provide healthcare for every child of the world.

It is a fact that rather than complying with the spirit of agreements reached during the Uruguay Round negotiations of the World Trade Organization and reducing levels of agricultural subsidies, developed countries have actually increased those subsidies. At the same time, developing countries have been forced to reduce or eliminate their subsidies under pressure from international donors. Developed countries are practicing a double standard – protection for the rich and the free play of market forces for the poor.

A study [1] was conducted by an international NGO to expose the double standards of developed countries and damaging effect of subsidies. They tried to prove in few case

studies conducted in Pakistan, Kenya, Indonesia, Nigeria and Swaziland that how farmers and workers are suffering and national food security is being undermined, by unfair agricultural trade rules and practices of developed countries.

2.a Impact of New Trade Paradigm (AOA) on Pakistan

The WTO Agreement on Agriculture (AoA) has created a negative impact on Pakistan agriculture sector due to various clauses incorporated in the AoA. In fact Pakistan was no fully prepared for Uruguay Round negotiations and could not anticipate proposals brought forward by the developed countries. Since Pakistan was not providing export subsidies on agriculture products prior to finalization of AoA, hence was restricted to provide export subsidies or could not find any lee way in the provisions of article 8 of AoA. Secondly Pakistan could not take relaxations within safe gourd measures. Thirdly Pakistan was not providing blue box subsidies to agriculture hence could not enjoy relaxation provided under article 6 of AoA,

Pakistan was providing product specific and non product specific domestic support for agriculture commodities but due to AMS restrictions could not continue beyond limit of deminims clause of article 6.4 of AoA. However, Pakistan is successful to protect its agriculture commodities through tariff bindings. Pakistan can still provide domestic support up to 10 percent of agriculture G.D.P but due to financial constraints this has also been restricted to wheat crop only. In fact in spite of many restricted clauses in agreement on agriculture Pakistan is unable to provide any support to its agriculture sector, compared with other developing and developed countries. It can be stated that due to absence of domestic support Pakistan's agriculture sector products are not competitive to produce domestically and to compete internationally.

3. The New Trade Paradigm Benefits for the Developed Countries

Under the World Trade Organization's Agreement on Agriculture (AoA) - effectively a bilateral agreement between the US and the EU imposed on other WTO member countries – subsidies that distort trade must be cut. It was decided that developed countries will cut subsidies by 25 per cent by 2000. This has not happened. Developed countries have reneged on the spirit of the Agreement on Agriculture and, instead of reducing subsidies, have actually increased them. The new US Farm Bill also threatened dramatically to increase the OECD figure still further, bringing more problems for developing country farmers.

The AoA also created new categories of agricultural support deemed not to affect or only partially affect production or trade. Since 1996, the EU and the US have substantially redesigned their subsidy systems in order to move payments to farmers into these new categories and evade subsidy

reductions. Unfortunately for developing countries, even if they could afford to subsidies their farmers, these "Blue Box" and "Green Box" subsidies - generally involving direct payments to individual farmers (rather than price support) require a fully staffed and efficient civil service, sophisticated accounting and banking systems, and high levels of literacy that are beyond most developing countries.

Thus, EU and US farmers continue to receive subsidizes. These encourage over-production and much of the additional produce is then dumped - sold below the cost of production – in the developing countries. This depresses prices and makes it difficult for their farmers to compete. As a result, many have been driven off the land.

In 2010, the EU spent €57 billion on agricultural development, of which €39 billion was spent on direct subsidies.[2] Agricultural and fisheries subsidies form over 40% of the EU budget.[3] Since 1992 (and especially since 2005), the EU's Common Agricultural Policy has undergone significant change as subsidies have mostly been decoupled from production. The largest subsidy is the *Single Farm Payment*.

The United States currently pays around $20 billion per year to farmers in direct subsidies as "farm income stabilization"[4][5][6] via U.S. farm bills. These bills date back to the economic turmoil of the Great Depression with 1922 Grain Futures Act, the 1929 Agricultural Marketing Act and the 1933 Agricultural Adjustment Act creating a tradition of government support. A Canadian report claimed that for every dollar U.S. farmers earn, 62 cents comes from some form of government, with total aid in 2009 from all levels of government adding up to $180.8 billion.[7]

The beneficiaries of the subsidies have changed as agriculture in the United States has changed. In the 1930s, about 25% of the country's population resided on the nation's 6,000,000 small farms. By 1997, 157,000 large farms accounted for 72% of farm sales, with only 2% of the U.S. population residing on farms.

The subsidy programs give extra money to farmers for their crops and guarantee a price floor. For instance in the 2002 Farm Bill, for every bushel of wheat sold, farmers were paid an extra 52 cents and guaranteed a price of 3.86 from 2002–03 and 3.92 from 2004–2007.[8] That is, if the price of wheat in 2002 was 3.80 farmers would get an extra 58 cents per bushel (52 cents plus the $0.06 price difference).

"Direct payment subsidies are provided without regard to the economic need of the recipients or the financial condition of the farm economy. Established in 1996, direct payments were originally meant to wean farmers off traditional subsidies that are triggered during periods of low prices for corn, wheat, soybeans, cotton, rice, and other crops. Direct payments of subsidies are limited to $40,000 per person or $80,000 per couple in US.[9]

In the US, corn is the top crop for subsidy payments. The Energy Policy Act of 2005 mandates that billions of gallons of ethanol be blended into vehicle fuel each year, guaranteeing demand, for US corn ethanol subsidies between $5.5 billion and $7.3 billion per year. Producers also benefit from a federal subsidy of 51 cents per gallon, additional state subsidies, and federal crop subsidies that can bring the total to 85 cents per gallon or more.[10] (US corn-ethanol producers are also shielded from competition from cheaper Brazilian sugarcane-ethanol by a 54-cent-per-gallon tariff [11][12])

On the other hand developing countries are not obliged to reduce their subsidies under WTO rules if their support to agriculture does not exceed 10 per cent of total food output. But the use of agricultural subsidies in poor countries is also influenced by the conditions of loans through the International Monetary Fund, the World Bank and regional development banks Like ADB.

The rules and policies of the WTO, the IMF, the World Bank and regional development banks, have actually coerced developing countries to reduce, sometimes eliminate subsidies to their agricultural sectors (In case of Pakistan condition of ADB under ASP-II Loan to abolish food procurement departments and to phase out wheat subsidy are quite known. Aid has often been made conditional on this. As a result, the use of farm subsidies in developing countries has decreased significantly over the past 15 years. While many farmers in developing countries now receive no help at all, large landowners in Europe are benefiting hugely.

4. Impact of Subsidies on Global Food Prices and International Trade

Although some critics and proponents of the World Trade Organization have noted that export subsidies, by driving down the price of commodities, can provide cheap food for consumers in developing countries,[13][14] low prices are harmful to farmers not receiving the subsidy. Because it is usually wealthy countries that can afford domestic subsidies,

critics argue that they promote poverty in developing countries by artificially driving down world crop prices.[15] Agriculture is one of the few areas where developing countries have a comparative advantage, but low crop prices encourage developing countries to be dependent buyers of food from wealthy countries. So local farmers, instead of improving the agricultural and economic self-sufficiency of their home country, are instead forced out of the market and perhaps even off their land. This occurs as a result of a process known as "international dumping" in which subsidized farmers are able to "dump" low-cost agricultural goods on foreign markets at costs that un-subsidized farmers cannot compete with. Agricultural subsidies often are a common stumbling block in trade negotiations. In 2006, talks at the Doha round of WTO trade negotiations stalled because the US refused to cut subsidies to a level where other countries' non-subsidized exports would have been competitive.[16]

Others argue that a world market with farm subsidies and other market distortions (as happens today) results in higher food prices, rather than lower food prices, as compared to a free market.[*citation needed*]

Mark Malloch Brown, former head of the United Nations Development Program, estimated that farm subsidies cost poor countries about US $ 50 billion a year in lost agricultural exports:

"It is the extraordinary distortion of global trade, where the West spends $360 billion a year on protecting its agriculture with a network of subsidies and tariffs that costs developing countries about US$50 billion in potential lost agricultural exports. Fifty billion dollars is the equivalent of today's level of development assistance."[17][18]

5. Impact of Subsidies on Consumer Prices and Food Security

The cheap price of dumped food imports seems to be beneficial to consumers in developing countries. In the short term this can be true. But low imported staple food prices also undermine the livelihoods of local farmers, and the farm workers they employ, often driving them from their land.

In turn, this leads to an increasing dependence on imports to ensure national food security and greater vulnerability to world price increases and exchange rate volatilities. The cheap supplies can dry up at any time, and local agriculture crippled by dumping is in a weak position to produce once more for local markets.

It is widely predicted that reducing subsidies in developed countries would increase world prices. While this would benefit poor countries exports, it would have a detrimental impact on developing countries that are net-food importers. As a cushion from this impact, developed countries should use some of the money they no longer pay in subsidies to create a revolving compensatory fund for net-food importing countries. A mechanism for compensation to resource poor small farmers affected by the subsidies provided to resource rich farmers in the developed countries needs to be developed.

Higher prices at the farm gate would enable all farmers to achieve better returns from their labour. Currently most of the profits from farm produce go to the traders, manufacturers and retailers. In the UK, retail prices are currently increasing while prices to farmers are decreasing especially small land holders. Therefore a reduction in subsidies does not have to mean an increase in prices for consumers, if the revenues from the food are shared more equitably.

6. Impact on Poverty in Developing Countries

The impact of agricultural subsidies in developed countries upon developing-country farmers and international development is well documented. Agricultural subsidies depress world prices and mean that un-subsidized developing-country farmers cannot compete; and the effects on poverty are particularly negative when subsidies are provided for crops that are also grown in developing countries since developing-country farmers must then compete directly with subsidized developed-country farmers, for example in cotton and sugar.[19] The IFPRI has estimated in 2003 that the impact of subsidies costs developing countries $24Bn in lost incomes going to agricultural and agro-industrial production; and more than $40Bn is displaced from net agricultural exports.[20] Moreover the same study found that the Least Developed Countries have a higher proportion of GDP dependent upon agriculture, at around 36.7%, thus may be even more vulnerable to the effects of subsidies. It has been argued that subsidised agriculture in the developed world is one of the greatest obstacles to economic growth in the developing world; which has an indirect impact on reducing the income available to invest in rural infrastructure such as health, safe water supplies and electricity for the rural poor.[21] The total amount of subsidies that go towards agriculture in OECD countries far exceeds the amount that countries provide in development aid.

7. Impact on Corporate Farms

Some proponents view farm subsidies as appropriate for "family" or small farmers, but inappropriate for "corporate" or large farms. Many subsidy programs have limits on the size of the farm that can receive subsidies.

Critics also argue that agricultural subsidies go mostly to the biggest farms who need subsidization the least. Research from Brian M. Riedl at the Heritage Foundation showed that nearly three quarters of subsidy money goes to the top 10% of recipients.[22] Thus, the large farms, which are the most profitable because they have economies of scale, receive the most money. Between 1990 and 2001, payments to large farms have nearly tripled, while payments to small farms have remained constant.[23] Brian M. Riedl argues that the subsidy money is helping large farms buy out small farms. "Specifically, large farms are using their massive federal subsidies to purchase small farms and consolidate the agriculture industry. As they buy up smaller farms, not only are these large farms able to capitalize further on economies of scale and become more profitable, but they also become eligible for even more federal subsidies—which they can use to buy even more small farms."[24] Critics also note that, in America, over 90% of money goes to staple crops of corn, wheat, soybeans, and rice while growers of other crops get shut out completely. In Europe, for instance the Common Agricultural Policy has provisions that encourage local varieties and pays out subsidies based upon total area and not production. Other points aside, research has shown that small farms receive more payments in relation to value of their crops than big farms.[25] The tariffs on sugar have also forced most large candy makers in the USA to Canada and Mexico where sugar is often half to a third the price.[26]

8. Impact on Non-farming Companies

Subsidies are also given to companies and individuals with little connection to traditional farming. It has been reported that the largest part of the sum given to these companies flow to multinational companies like food conglomerates, sugar manufacturers and liquor distillers. For example in France, the single largest beneficiary was the chicken processor Group Doux, at €62.8m, and was followed by about a dozen sugar manufacturers which together reaped more than €103m.

9. *Use of Subsidies for* Public Goods

Sustainable development is currently the focus of debate all over the world. EU and US farm subsidies have encouraged the use of environmentally unsound methods, such as the use of large quantities of chemicals, which are inherently unsustainable. In line with the urgent need for sustainable development, developed countries should redistribute and retarget their agricultural subsidies towards the delivery of public goods - such as conserving the environment, enhancing rural development and promoting more sustainable agricultural practices. In addition, particularly in developing countries, subsidies should also be targeted at addressing other market failures, such as food distribution to the poor and supporting food security crops and produce.

10. Public Economics Implications

In Economics, agricultural subsidies are considered a price support put in place to serve as a primary instrument of supporting farmers' income and protecting the country's food supply. However, agricultural commodities are considered private goods; goods that are rival and excludable in consumption. Therefore, the government's involvement in the agricultural sector can be contentious. Some proponents argue without subsidies, rural America's economy would suffer greatly and America would become dependent on foreign food sources, which is considered a national security threat. However, critics argue that the intervention of government in agricultural subsidies prohibits the price mechanism to drive commodity prices as they would in the private market, therefore creating crop overproduction and market discrimination.

Critics also suggest that subsidies are an inefficient use of taxpayer's money as they represent transfer payments to above average Americans given that in 2006, the Department of Agriculture estimated that the average farm household income was $77,654 or about 17% higher than the average U.S. household income.[27] From a public economics perspective, subsidies of any kind work to create a socially and politically acceptable equilibrium that is not necessarily Pareto Efficient.[28]

11. Comparison of Subsidies to Farmers of Pakistan and UK

In the Rasoolpur village of Pakistan, Mithan, a widow, cultivates two acres of wheat, which provides feed for her and her three children. But Mithan is struggling to cope after the Pakistan government cut its support to

farmers. Government officials did not come to the village looking to buy wheat at the official price, as they normally do. I now can't arrange schooling for my children, Mithan told to a researcher.

Mithan, like millions of small-scale, resource-poor farmers in Pakistan receives no subsidy to help her produce wheat. It is a very different picture for the EU's large-scale, resource-rich farmers. Inequalities in the distribution of EU farm subsidies mean the larger the farm, the greater the subsidy. In the UK, the Duke of Westminster, for example, with farm holdings of about 55,000 hectares, receives almost £300,000 a year in farm subsidies from the tax payer.

The farming enterprises of Lord Iliffe and his family, owners of around 15,000 hectares, have received nearly £3 million in direct payments from the taxpayer in the last ten years. Lord de Ramsey, head of the de Ramsey Estate, has 4,500 hectares spread over at least three large farms. These farms received £495,000 in subsidy payments in 1996.

12. A Case of Wheat and Sugar Subsidies (*Highly Subsidized US, EU Products with Detrimental impacts in Developing Countries)*

Subsidies have led to surplus production and dumping in developing countries, exacerbating the problems of their small farmers. Wheat provides a classic example of the damage subsidies can do. Wheat is a staple food crop in many parts of the world. The US, EU, China and India dominate world wheat production with about half of all wheat (and wheat flour) traded on world markets coming from the EU and US.

The EU has historically ensured that returns to its wheat farmers are artificially high. Farmers in the EU have been encouraged to produce wheat with a combination of market price support - including through intervention buying under Amber Box Domestic Support and Export Subsidies - and direct payments under Blue Box Support. Both contribute to over production and surpluses.

Under Amber Box Domestic Support Subsidies intervention buying, the European Commission sets a minimum price for certain commodities, including wheat. The intervention price has historically been higher than the world price. Storage agencies in each EU member country are obliged to purchase farm produce in over supply at this price.

The cost of producing wheat in the UK (and the EU) is currently higher than the price farmers receive. Left to the market, this means that it would no longer make sense for UK farmers to grow wheat. But UK farmers are by no means left to the market. To compensate them for reductions in the intervention price, they are compensated through Blue Box direct payments under the Arable Area Payments Scheme, introduced in 1992, this continues to ensure large-scale wheat growers a reasonable return. The scheme provides farmers with about £ 30 a tone of wheat. It gives farmers the incentive they need to carry on overproducing wheat.

Each tone of UK (and EU) wheat sold on international markets sells at about 40 per cent below the cost of production - in other words, it is dumped. As demonstrated in case studies in Pakistan, Nigeria, Indonesia and Bangladesh, this is having a detrimental impact on farmers and food security in developing countries.

Through farm supports, such as quotas, intervention prices, export subsidies and import tariffs, sugar beet producers in the EU are supported by a system that raises the price of sugar in EU countries to artificially high levels - far in excess of the world price. One way of maintaining high internal prices for EU sugar is to export surpluses. Export subsidies are available to exporters to bridge the gap between the high EU price and the lower world price.

For many developing countries, sugar is an important crop; for some it is a key export earner. Sugar is an agricultural sector in which developing countries have a distinct cost advantage over the European Union.

Sugar producers and processors in EU countries stay in business only through the use of subsidies. The EU's subsides to the sugar sector are causing huge problems for small-scale farmers in developing countries, eradicating their competitive advantage. Export subsidies enable sugar traders to export surpluses at prices significantly below the cost of EU production. Again, as with wheat, the product is dumped.

Pakistan for example, produces sugar at less than cost of EU countries, and yet is unable to compete with the EU imports that increasingly dominate its market - and also neighboring markets. The sugar industry plays a crucial role in the Pakistan's economy. Subsidized dumped EU sugar products (primarily confectionary products) are seriously undermining the Pakistani sugar processing industry, leading to hundred N thousand the loss

of jobs in the Pakistani sugar industry and many indirect jobs linked to the industry, such as packaging and transport.

13. Conclusion

WTO rules permit the OECD countries to continue to provide massive support to their agricultural sectors. These subsidies distort production, trade and prices with detrimental impacts on developing countries. They widen the gap between rich and poor countries and farmers. While they themselves make use of heavy farm subsidies, developed countries put pressure on poorer countries not to use them. Decisions about the Common Agricultural Policy in the EU and the Farm Bill in the US should be consistent with the WTO Agreement on Agriculture signed by both the EU and the US.

Pakistan's policy the Doha Round negotiations should be more offensive demanding that international trade rules to be reformed to:

1. Substantially reduce the level of agricultural support in the developed world;
2. **Phase out, as soon as possible, agricultural subsidies in the developed world those distort production and trade and which lead to dumping;**
3. Eliminate all types of export subsidies immediately;
4. Redirect remaining subsidies to the developing world towards conserving the environment, promoting rural development and target them at small-scale farmers and more sustainable agricultural practices;
5. Some provisions should be made in the WTO Agreement on Agriculture to enable developing countries to support and protect their small farmers and key food security crops, and feed their people.
6. Developed Countries should establish a Food Security Revolving Fund for the Developing countries.

The government of Pakistan should evaluate the benefits of the Pakistan's Agricultural Subsidy Program, which is being implemented to increase agricultural productivity and food security. The subsidy is being provided by means of procurement price of wheat. Should this system be continued to maximize production and economic and social gains? Many practical and political challenges remain in the program and required to increase efficiency, control costs, and limit patronage and fraud.

14. References

1. Farmgate Scandal Report, Action Aid International e.
2. "Title 05 — Agriculture and rural development". http://eur-lex.europa.eu/budget/data/D2010_VOL4/EN/nmc-titleN123A5/index.html. Retrieved 2011-08-01.
3. http://ec.europa.eu/budget/budget_glance/what_for_en.htm
4. *"Farm Income and Costs: Farms Receiving Government Payments"*. USDA
5. USDA 2006 Fiscal Year Budget. "USDA Budget Summary 2006. Farm and Foreign Agriculture Services". http://www.usda.gov/agency/obpa/Budget-Summary/2006/06.FFAS.htm.
6. Farm subsidies and obesity in the United States: National evidence and international comparisons
7. Barrie McKenna For U.S. farmers, subsidies the best cash crop *The Globe and Mail* 25 November 2010
8. "The 2002 Farm Bill: Title 1 Commodity Programs". USDA. 2002-05-22. http://www.ers.usda.gov/Features/farmbill/titles/titleIcommodities.htm. Retrieved 2006-12-06.
9. http://farm.ewg.org/farm/dp_text.php
10. Sweet, William. "Corn-o-Copia." IEEE Spectrum. January 2007
11. *Brazilian Sugarcane Industry Responds to Introduction of Pomeroy-Shimkus Legislation That Taxes Clean, Renewable Energy*
12. *Brazil raises cane over U.S. ethanol tariff*
13. Panagariya, Arvind (2005–12). "Liberalizing Agriculture". Foreign Affairs. http://www.foreignaffairs.org/20051201faessay84706/arvind-panagariya/liberalizing-agriculture.html. Retrieved 2011-08-15.
14. Center for Economic and policy research (2005-11-22). "World Bank's Claims on WTO Doha Round Clarified". Press release. http://www.cepr.net/pressreleases/2005_11_22.htm.
15. Andrew Cassel (2002-05-06). "Why U.S. Farm Subsidies Are Bad for the World". Philadelphia Inquirer. http://www.commondreams.org/views02/0506-09.htm. Retrieved 2007-07-20.
16. "US blamed as Trade Talks end in acrimony". Financial Times. 2006-07-24. http://www.ft.com/cms/s/0/dfa460d0-1afd-11db-b164-0000779e2340.html. Retrieved 2008-05-18.
17. Address by Mark Malloch Brown, UNDP Administrator, Makerere University, Kampala, Uganda, 12 November 2002
18. "Farm Subsidies That Kill", July 5, 2002, By NICHOLAS D. KRISTOF, New York Times
19. "Agricultural Subsidies, Poverty and the Environment". World Resources Institute. January 2007. http://pdf.wri.org/aspe_domestic_reform.pdf. Retrieved 2011-02-25.

20. "How much does it hurt? The Impact of Agricultural Trade Policies on Developing Countries". IFPRI. 2003. http://www.ifpri.org/sites/default/files/pubs/media/trade/trade.pdf. Retrieved 2011-02-25.
21. "Farm subsidies: devastating the world's poor and the Eenvironment". http://www.ncpa.org/pub/ba547. Retrieved 2011-02-25.
22. Riedl, Brian M. (2002-04-30). "Still at the Federal Trough: Farm subsidies for the rich and famous shattered records in 2002".
23. Heritage Foundation. http://www.heritage.org/Research/Agriculture/BG1542.cfm.Retrieved 006-12-27.
24. "Farm Programs: Information on Recipients of Federal Payments" (PDF). US General Accounting Office. 2001–06. pp. 14.
25. http://www.gao.gov/new.items/d01606.pdf. Retrieved 2011-18-20.
26. http://reclaimdemocracy.org/articles_2005/sugar_industry_subsidies.php.
27. Thompson, Wyatt; Mishra Ashok, Joe Dewbre (15). "Farm Household Income and Transfer Efficiency: An Evaluation of United States Farm Program Payments". *American Journal of Agricultural Economics* **91.5**: 1926-1301.
28. Rosen, Harvey (2008). *Public Finance*. New York: McGraw-Hill Irwin. pp. 83–84.

V. TRANSPORTATION COST MODEL

By

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1. Abstract

A cotton gin in the Mississippi Delta area produces from 100 to 150 pounds of gin waste for each 450 pound bale of lint cotton. This waste requires investment, time, and resources to be moved away from the gin site. Presently, one gin pays from $ .50 to $ 1.75 per bale depending on the number of bales ginned, to have cotton gin waste hauled away by contractors. This study explores the possibility of moving the waste with a least possible cost to a central place where it would be further processed and converted into a useful product. An aggregate travel-cost model was used to determine the optimal location for two processing plants. The study concluded that the waste could be moved to an optimal location costing 57 cents to 69 cents per bale. These rates seemed to be lower than the prevailing rates in the region.

2. Importance of Industry Location

Traditionally, industries display one of three location orientations with respect to their markets and resources i.e. resource-oriented; market oriented; and intermediate point- oriented. Among the most important factors that influence the choice of location for manufacturing industries are nearness to market, source of raw materials, availability of fuel or power, and labor supply. The general principle governing the location of manufacturing industries, in terms of transportation costs, is that an industry will tend to locate where the aggregate transportation charges are the least. This may be at the source of supply of some important raw material; it may be at the market for the finished product; it may be at the source of fuel supply; or it may be at some intermediate point. It must also be recognized that the importance of transportation charges will vary with different industries. If transportation costs are a larger factor in the cost of production, and large relative to the value of the commodities produced, they may be the controlling factor in the location of industry. If transportation costs are but a small part of the cost of production, and small relative to the value of the commodities produced, they may have little or no influence in the selection of locations.

Whether the industry will be drawn toward the raw materials or toward the market for finished products will depend upon the relative cost of transporting the raw materials and the finished goods. If the rates on the raw materials are higher than on the finished product, there will be an advantage in locating near the raw materials. If the rates on the finished products are higher than on the raw materials, there will be an advantage in locating near the centers of consumption, unless this advantage is offset by loss of weight in the manufacturing process. It should be noted that normally the rate on the raw materials are lower than on the finished product. Also industries may be expected to locate near the source of raw materials which shrink in weight in the process of manufacture. This explain, in part, why sawmills penetrate into the wilderness and why wood-using industries are commonly located near the supplies of growing timber.

The aggregate-travel or transportation-cost model serves a plant. It is a means of finding an optimal location for a plant. It is a means of finding the relative cost of collecting an input to a location of known spatial distribution, based on the measurement of the total cost or coverage of distance.

The aggregate travel (transport cost) model was used in the Mississipi Delta Area to collect the gin waste at a minimum cost. This model can be replicated in Pakistan for choosing location for any industry. Mathematically the model can be expressed as:

$$Z_i = \sum_{i=j}^{n} Q_i T_{ij}$$

Where z_i = is the aggregate cost involved of moving gin waste from all sites to plant location;

Q_i = number of truck loads of gin waste at each site;

T_{ij} = cost per trip of gin waste from site i to plant location j.

This simple mathematical model can be used to determine the optimal location by deriving the values of Zi, which is the aggregate cost of hauling gin waste from all sites to a given location. The site with the least value in the output matrice is the optimal location for the processing plant.

3. Assumptions of the Model

The basic assumptions of the model are as follows:

1. The processing plant uses only gin waste, and converts it into a homogenous product.
2. The unit cost of waste at any gin is constant, irrespective of quantity transported to plant j.
3. The amount of gin waste is fixed at each site.
4. Unit production costs at any plant location are constant, irrespective of scale and capacity of the plant.
5. Transportation cost varies, depending upon the milage covered.

The disposal of cotton gin waste is a significant problem in the cotton ginning industry. For spindle-picked cotton, 100 to 150 lbs of cotton gin waste per bale of lint must be handled. Cotton gin waste is already collected at the gins, but needed to be transported from the gins to a central location where it could be further processed and converted into a useful product. Since gin waste is a bulky and low value density material, therefore more emphasis should be placed on its transportation cost.

Sakashita (1967) examined the location problem of a firm in one dimension. Using a linearly homogeneous production function, he considered the case of a firm utilizing two inputs. Assuming the transportation rates on the inputs to be constant and that on output to be

zero, he established that a cost minimizing firm would only locate at one of the fixed location of its inputs, and never at an intermediate point. Woodward (1973) found that under cost-minimization, the firm's location is independent of the output level when the transportation cost of output is positive (zero), if the production function is linearly homogeneous.

Khalili et. al. (1974) considered the location problem of a firm in two dimensions that is the two inputs of the firm and the output market are located at the vertices of a triangle. He established three propositions:

(i) Homotheticity of the firm's production function (which is equivalent to the firm's expansion path being a ray through the origin) is the necessary and sufficient condition for the optimum production location to be invariant with respect to the output level when the firm is constrained to remain at a specified distance from the market;

(ii) With the distance from the market variable, the necessary and sufficient condition is linear homogeneity of the production function; and

(iii) With a homogeneous production function, the firm would move towards (away from) the market under increasing (decreasing) return to scale.

Further, Khalili et. al. (1974) demonstrated that the firm would never locate on the line joining the market to either of the two inputs.

Moses (1958) investigated how changes in a firm's location at a constant distance from the market point affect the efficiency conditions governing the firms consumption of inputs which needed to be transported from two different points. He concluded that a production function homogeneous of degree one is sufficient to ensure an optimum location independent of the level of output, as long as the transportation rates are constant or depend solely on haulage distances. However, if transport rates are also allowed to vary with haulage volume, then the condition sufficient for an output-independent optimum location solution must be extended to cover not only the necessary nature of the production function, but also the necessary nature of both the elasticity of transport rates with respect to quantities shipped and the marginal productivities of the inputs. The reason for this is that changes in transport rates with respect to quantities shipped will demand

changes in the total number of ton-miles hauled and, with variable proportions coefficients, this could lead to factor substitution in either direction. The actual impact of changes in transport rates with respect to haulage volume will depend not only on their elasticities with respect to haulage volume, but also on their absolute levels.

Weber approached the location problem by making three basic assumptions, in order to eliminate many of the complexities of the real world. First, the geographical basis of materials is given (that is, fuel and other raw materials are found in some localities only). Second, the situation and size of places of consumption are given, with the market comprising a number of separate points. Condition of perfect competition are implied, with each producer having an unlimited market with no possibility of deriving monopolistic advantages from choice of location. Third, there are several fixed labor locations, with labor immobile and in unlimited supply at a given wage rate.

There are three factors that influence industrial location, two general regional factors of transport and labor costs, and the local factor of agglomerative or deglomerative forces. Weber (1929) first examined the manner in which the point of minimum transport costs can be found and then the circumstances in which labor or agglomeration advantages will operate. Transport costs are viewed as the primary determinant of plant location. Costs are not considered directly, however, but as a function of weight to be carried and distance to be covered. Weber demonstrated the derivation of the least- transport-cost location by using the locational triangle. He took from his simplified space economy one point of consumption (C) and the most advantageous deposits of the two necessary materials (M1 and M2) as framework within which to examine the way any factory will be located. The least- transport-cost location is the point at which the total ton- miles involved in getting materials to a place of production and the finished product to the market is at a minimum; each corner of the triangle exerts a pull on the point, measured by the weight to be transported from or to the corner (in the case of market). The point can be found by a simple application of the theorem of the parallelogram of forces. It can also be discovered by the use of Varignon's mechanical model, in which weights of appropriate size attached to the pieces of string passing over pulleys are suspended from the corners of the triangle; the three pieces of string are tied together, and the position within the triangle where the knot comes to rest indicates the point of compromise between the three forces.

Palander (1935) used Weber's isodapane technique to demonstrate the effect of transport costs on location. He made an important distinction between rates that rise evenly with distance and the more realistic arrangement under which the rate tends to fall off with distance travelled. The uniform rate will produce a series of isovectors around a given point taking the form of concentric circles spaced at regular intervals, whereas the variable rate makes the isovectors successively further apart as cost per unit of distance falls. A uniform increase in the transport costs in relation to distance from each point makes isodapanes interpolated from the three sets of isovectors reveal a least-transport-cost point within the triangle whereas with variable freight rates locations at the corners are more attractive.

Hoover's (1936) early work on industrial location is still among the most useful particularly for those who seek a clue to the general nature of the location problem. He started with the assumption of perfect competition between producers or sellers at any one location and perfect mobility of factors of production and transportation costs and extraction or production costs as the determinants of location. In case of extractive industries with known location of deposits, the delivered price to any buyer will be the cost of extraction plus transport costs. Buyers will obtain the commodity from the source that offers the lowest delivered price and the boundary between the market area of two producers will be a line joining points at which delivered price is the same from both sources. He also pointed out that in the absence of production cost differences the best location will be at the minimum transport cost, which may be at a material source, at the market, or at an intermediate point. The least-transport- cost location is found by constructing isotims (lines joining points where a commodity costs the same) around given material and market points, from which lines of equal total transport cost (isodapanes) can be constructed.

August Losch (1954) approached the location problem by seeking the location at which revenue is the greatest i.e. total revenue exceeds total cost by the greatest amount. He determined the total attainable demand and the best volume of production as a function of factory price for a number of virtual factory locations separately. The greatest profit attainable at each of these points were determined from the cost and demand curves, and from this place the greatest money profits, the optimal location were found.

Martine Labbe and s. Louis Hakimi (1991) considered a two-stage location and allocation game involving two competing firms. The firms select the location of their facility on a network. Next the firms optimally select the quantities each wishes to supply to the markets, which are located at the vertices of the neb10rk. The criterion for optimality for each firm is profit maximization, which is the total revenue minus the production and transportation costs. Under reasonable assumptions regarding the revenue, the production cost and the transportation cost functions, they showed that there would be a Nash equilibrium for the quantities offered at the markets by each firm. When the quantities supplied (at the equilibrium) by each firm at each market are positive, there would be a Nash location equilibrium, i.e. no firm would find it advantageous to change its location.

Dennis O. Olson and Yeung-Nan Shieh (1990) examined the theoretical implications of quantity-discounted transportation rates on the optimum location decision of the firm. In a two- dimension, n-input space, when the transportation rate is independent of quantity of distance shipped, the linearly homogeneous production is easily generalized to the case where transportation rates depend upon distance shipped. When transportation rates depend upon quantity shipped, the firm's location decision cannot be made independently from its production decision unless (1) the elasticities of transportation rates with respect to quantity shipped are constant and identical, and (2) the ratio of marginal products to the marginal transportation costs are equal for each input.

Melvin Greenhut (1956) studied various important factors which influence plant location. He listed these as transportation, processing costs, the demand factor, and "cost reducing" and "revenue increasing" factors. Greenhut felt that transportation is the major determinant of plant location. An entrepreneur will tend to economize on transportation if freight costs comprise a large part of total costs, but only if transfer costs vary significantly at different locations. Material orientation as a product of transport costs *is* considered, and it is concluded that it occurs in two special cases: (1) where the materials are perishable, and (2) where transport cost on the material is much greater than on the finished product.

Walter Isard (1956) analyzed the locational equilibrium of the firm under transport orientation and showed how the substitution approach is applied. The framework is the familiar locational triangle, with the market at one corner (C), sources of two materials at the other corners (Ml and M2). The initial problem is to find the

optimum location, given certain assumptions regarding freight rates and quantity of material needed, for a plant at some distance form one corner of the triangle. The arc, which represents a locus of possible points, is transposed into a transformation line on a graph in which distance from M1 is plotted against distance from M2. Moving along the transformation line distance from one source point decreases while from other point of source increases; in other words, transport inputs from one point are being substituted for transport inputs from another. To find the optimum or least-cost location along the curve, it is necessary to add equal outlay lines and the optimum point will be the one at which it is tangential to the lowest value equal outlay line.

4. Summary

The overall objective of the this study was to determine an optimal location for two cotton gin waste disposal facilities so that this waste produced could gin waste disposed off in an acceptable way. Cotton acreage, production, and number of bales ginned at the country level were obtained from the National Agricultural Statistics Service (NASS). Locations of the existing gins in the study area were identified by using the Cotton Ginners Association Blue Book. Since the actual number of bales processed per gin was not available, this figure was derived by dividing the number of gins into the number of bales processed at the country level. The amount of waste was estimated using three conversion rates – 100, 125, and 150 pound waste per bale.

Two processing plants were proposed for the study area. A total of 66 gins located in the Upper Delta and North Central districts would deliver the gin waste to the first plant. The actual number of bales processed by these gins were estimated at 668.4 thousand bales during the period 1988-92, and produced 30,317 tons of waste based on a 100 pound conversion rates. A second plant was proposed for the Lower Delta and Central districts. Here, 73 gins located at 42 sites would deliver the gin waste to the second plant. These gins produced 46,082 tons of gin waste based on a 100 pound conversion rate.

Since transportation cost is a function of distance and weight or volume to be shipped, the distance between waste producing sites was determined using a software called "Auto Map". A road map was also used

where the requisite information was not available from the Auto Map program. It was assumed that the distance between the gins within each site/town is negligible and has little or no affect on the transportation charges. Dump tracks will be used to move the waste from each site to the processing plant. Transportation charges were obtained from the Mississippi Public Service Commission. For first processing plant, a 43x43 matrix consisting of transportation costs was multiplied by a 43x1 matrix showing the number of truck loads at each site. The elements in the output matrix showed the total transportation costs from each site to the plant. The same methodology was used for the second plant.

5. Conclusions

An aggregate travel cost model was used to determine the optimal locations for both plants. The first plant would process cotton gin waste from 66 gins located in the Upper Delta and North Central districts. The results showed that Lyon was the optimum site because it had the lowest transportation costs. A total of 3,013 truck loads would be shipped to site at a cost of $445,423. The average cost per truck was estimated as $151.15 and the cost of building per bale was 69 cents. These estimates were the lowest compared to the remaining 42 sites.

Similarly, for the second facility, Silver City had the lowest hauling cost. This site would handle 4,591 truck loads at a cost of $580,314. The average cost per truck was estimated as $126.40 and the per bale cost was 57 cents.

6. References

1. Khalili, Amir, Vijay K. Mathur, Diran Bodenhorn. 1974. "Location and the Theory of Production: A Generalization, "Journal of Economics Theory, 9, pp 467-475.

2. Olson O. Dennis, Shieh Yeung-nan "A note on Transportation Rates and Location of the Firm in a Two-Dimension, n-Input Space" Journal of Regional Science, Vol. 30, No. 3, 1990, pp 427-434.

3. Fryrear, D.W. and D.V. Armbrust. 1969. "Cotton gin trash for wind erosion control". Texas Agricultural Experiment Station, Texas A&M University, Publication MP-928, 7pp.

4. Beck, S.R. and L.D. Clements. 1982. Ethanol production from cotton gin Trash". In: Proceeding of the Symposium on cotton Gin Trash Utilization Alternatives, National Science Foundation et. Al., pp.163-181.

5. Jerger, D.E., M.P. Henry, S. Ghosh, D.Q. Tran, S. Babu, and D.P. Chynoweth 1982. "Gasification of land-based biomass". Gas Research Institute report no. GRI-81.0080, 186pp.

6. Parnell, C.B., Jr. 1981. "Gin trash cotton utilization research in Texas-an update". In: Proceedings of the gin waste utilization Roundup and tour, University of California at Davis, pp. 37-43.

7. Williams, G.F., P. Piumsomboon, and C.B. parnell, Jr. 1982B. "A systems engineering model for cotton gin trash utilization". Transactions of the ASAE, pp. 802-810.

8. Biblis, E.J. 1977. "The manufacture of building materials from ginning wastes". In: Proceddings of the Gin-Waste-Utilization and Stick-Separation Seminar, Cotton Incorporated, pp. 41-42.

9. Dernovich, A.V. and L.A. Priz. 1987. "On the potential for use of cotton gin trash in the hydrolysis industry". Hydrolysis of Wood into chemical s (USSR), Allerton press, New York, no. 6, pp. 58-59.

10. Kenneth B. young and Mesbah U. Ahmed (1978). "Economics of Using Cotton Gin Trash as a Supplemental Feed for Range Cattle". Journal of Range Management 32 (2), March 1979.

Annexure-I

Transportation Cost of Gin Waste to Potential Sites

Town/Site	Total cost ($)	Cost/Bale ($)	Town/Site	Total Cost ($)	Cost/Bale ($)
Silver City	580314	0.57	Bentonia	907084	0.9
Belzoni	627378	0.62	Drew	925989	0.91
Inverness	635171	0.63	Chatham	929120	0.92
Holly Ruidge	672076	0.66	Goodman	944979	0.93
Panther Burn	678007	0.67	Schlater	956194	0.94
Midnight	689320	0.68	Vaughan	961826	0.95
Isola	692742	0.68	Satartia	995264	0.98
Indianola	704881	0.7	West	1012176	1
Hollandal	708563	0.7	Canton	1033160	1.02
Delta City	715643	0.71	Rome	1076291	1.06
Tchula	720902	0.71	Flora	1226958	1.21
Arcola	725752	0.72			
Yazoo City	734824	0.73			
Anguilla	735067	0.73			
Greenwood	746845	0.74			
Leland	763684	0.75			
Itta Bena	765787	0.76			
Avon	775144	0.77			
Rolling Fork	799072	0.79			
Cruger	814639	0.8			
Stoneville	820054	0.81			
Morgan City	820750	0.81			
Greenville	821975	0.81			
Lexington	824450	0.81			
Cary	824515	0.81			
Glen Allan	826747	0.82			
Benton	832411	0.82			
Sidon	838942	0.83			
Holly Bluff	892063	0.88			
Minter City	897979	0.89			
Winterville	903253	0.89			

Source: National Agricultural Statistics Service (NASS), Mississippi.

Annexure-II

Hauling Cost of Gin Waste Per Bale to Second Plant

Town/Site	No. of Gin	Distance from Plant	Cost per Trip ($)	Cost per Bale ($)
Silver City	1	1	100.00	0.45
Midnight	1	6	100.00	0.45
Belzoni	2	9	100.00	0.45
Isola	1	15	100.00	0.45
Inverness	2	21	100.00	0.45
Morgan City	3	24	100.00	0.45
Yazoo City	1	24	100.00	0.45
Anguilla	1	25	100.00	0.45
Sidon	1	26	100.00	0.45
Holly Bluff	2	27	100.00	0.45
Hollandal	4	28	100.00	0.45
Tchula	4	29	100.00	0.45
Benton	1	30	100.00	0.45
Indianola	5	30	100.00	0.45
Panther Burn	1	31	100.75	0.46
Rolling Fork	2	31	100.75	0.46
Delta City	1	33	107.25	0.49
Itta Bena	2	34	110.5	0.50
Cruger	1	37	120.25	0.55
Greenville	2	37	120.25	0.55
Holly Ruidge	1	38	123.5	0.56
Lexington	1	40	130.00	0.59
Cary	2	40	130.00	0.59
Satartia	2	41	133.25	0.60
Arcola	1	41	133.25	0.60
Avon	1	44	143.00	0.65
Chatham	1	45	146.25	0.66
Glen Allan	1	45	146.25	0.66
Canton	2	46	149.50	0.68
Bentonia	1	47	152.75	0.69
Leland	3	48	156.00	0.71
Schlater	2	49	159.25	0.72
Flora	2	49	159.25	0.72
Vaughan	1	53	159.00	0.72
Minter City	1	53	159.00	0.72
Drew	3	55	165.00	0.75
Goodman	1	55	165.00	0.75
Stoneville	2	56	168.00	0.76
West	1	60	180.00	0.82
Greenwood	4	60	180.00	0.82
Winterville	1	63	189.00	0.86
Rome	1	66	198.00	0.90

Source: National Agricultural Statistics Service (NASS), Mississippi.

VI. SUGAR BEET CULTIVATION IN KHYBER PAKHTUNKHWA

By

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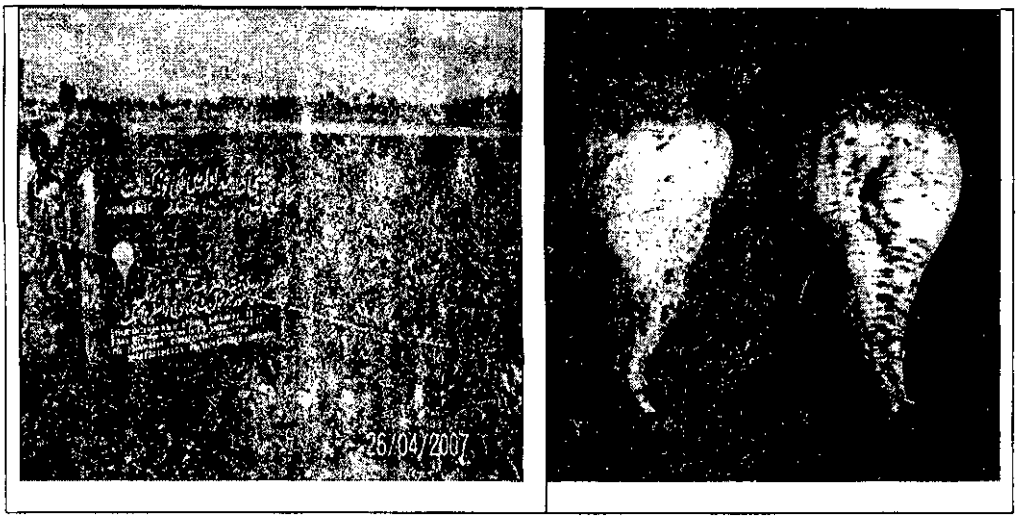
1. Abstract

Pakistan is the 10th largest global producer of sugar. Sugar industry is the country's second largest agro-industry after textiles. Despite efforts to achieve self sufficiency, Pakistan remains a net importer of sugar and resulting in a huge financial liability on the national exchequer. Even with overriding efforts of sugar mills to acquire cane, cane supply for every sugar mill is low and as a result runs underutilize alongwith low extraction rate due to deteriorated cane quality. To encounter with increased demands of sugar, sugar beet, a lesser water crop is an appropriate solution because it can produce almost two time higher sugar yield per hectare with less water and other inputs resources in a short period (5-6 months) as compared to sugarcane that needs 13-16 months, subject to the government and sugar industry's long-term objectives & appropriate arrangements for promotion of this crop.



2. Introduction

Sugar beet plant (Beta Vulgaris) belongs to Chenopodiaceae family. Beta Vulgaris is the only species of agricultural importance in this small family. It includes sugar and fodder beets. Several members of the family are common arable weeds.

The demand of human being for sweet foods is universal. Honey was the main sweetener in primitive time. The trade in sugar from sugarcane is also of primitive time. However, the sugar beet was recognized as a plant with valuable sweetening properties in the early 1700s and used primarily for production of sucrose, a high energy pure food.

Although beets have been grown as vegetables and fodder since antiquity, however, their use as a sugar crop is relatively recent. As early as in 1590, the French botanist **Olivier de Serres** extracted sweet syrup from beetroot, but the practice was not widely used. **The Prussian chemist Andreas Sigismund Marggraf** used alcohol to extract sugar from beets and carrots in 1747, but the methods did not lend themselves to industrial scale production. **Marggraf's former pupil and successor of Franz Karl Achard** began selectively breeding sugar beet from the **White Silesian fodder beet in 1784**. Under the patronage of **Frederick William III of Prussia**, he opened the world's first beet sugar factory in 1801 at Cunern in Silesia. By the beginning of the 19th century, his beet was approximately **5–6 percent sucrose compared to around 20 percent in modern varieties.**

The beet sugar industry in Europe rapidly developed after the Napoleonic Wars. In 1807, the British began a blockade of France. Blockade of Continental ports during the Napoleonic wars cut off the supply of sugar cane from the West Indies and favored development of an alternative source of sugar and sugar beet was developed in Europe in the eighteenth century from white Silesian beet, then a fodder crop. By the end of the wars, over 300 sugar beet mills operated in France and central Europe.

The first sugar beet mill in the U.S. opened in 1838 and the first commercially successful mill was established by E. H. Dyer in 1879. Sugar beet was not grown on a large scale in the United Kingdom until the mid-1920s.

3. Botanical & Agronomic Aspects of Sugar Beet Crop

Brief information about the botanic and agronomic aspects of the crop is presented as:

a) Sugar beet plant (Beta Vulgaris): It is herbaceous belonging to Chenopodiaceae, also known as the goosefoot family. It is a biennial plant completing its life cycle in two years. In its first year of growth, it develops a rosette of leaves and a large fleshy root, which stores the food reserve in the form of sugar. If it is left to grow, in the second year, it produces flowers and seed. However, as a sugar crop, it is grown annually and efforts are made for the maximization of sugar deposition in the root. The plant consists of three parts, namely crown, neck and root. The crown produces leaves and the root stores the sugar. The roots are cone-shaped ending in a slender tap form.

b) Sugar beet is a tropical and sub-tropical crop and can be cultivated in different climatic conditions. The seed germination requires 5-10 °C. High temperatures are preferred during vegetative growth. During day about 25 °C is required while in the night 20 °C is suitable. It grows best when soil moisture is between 40-60 centibars (cb). Excessive irrigation is not good after planting and prior to seed germination.

c) Soil requirement: Sugar beet crop flourish best in loam's and clay loam's with a near neutral pH. Acidic conditions are unfavorable to its growth. However, once established, sugar beet plants have a high tolerance against saline or alkaline conditions.

d) Land preparation: Sugar beet can be grown on flat beds or on ridges. The crop needs a good slope for which necessary ploughing (2-3 times), planking and leveling operations should be carried out. Depending on the method of sowing, flat beds or ridges 10-12 cm high and 50 cm apart are laid out before sowing.

e) Fertilization: Application of FYM at the rate of 20-30 tons/ha during land preparation is desirable. In addition, application of 5 bags of urea, 4 bags of DAP and 3 bags of SOP/hectare are recommended to provide the required amounts of nitrogen, phosphorus and potash nutrients for optimum growth. Whereas full amount of DAP and SOP is applied at the time of sowing, urea may be applied in 3 split doses i.e. at sowing, after thinning and after earthing up. **Results of experiments on N-fertilization of sugar beet by the Sugar Crops Research Institute, Mardan, suggest that 150 Kgs/ha N is the optimum and economical dose for achieving maximum beet and sugar yield.** Higher than the above dose has an adverse effect on sugar quality.

f) Irrigation: Sugar beet is low delta crop (27 acre inches) requiring 8-10 irrigation during the growth period. It is sensitive to both extremes, drought as well as excessive moisture. The latter is harmful to root quality. On an average, fields should be irrigated at 2-3 weeks interval. Adequate water supply is especially important during the critical growth stages namely formative, leaf growth and root development.

g) Sowing: Sugar beet is cultivated in Rabi season. October-November is considered an ideal month for sowing. Late sowing adversely affects quality and yield of sugar. Seed rate is about 5-8 Kg/ha. Soaking of seeds in water for 4-5-hours before sowing give higher germination.

h) Thinning & Topping: Thinning should be done when seedlings are at 3-4 leaf stage. Gap filling if required should be done soon after germination. The roots also need topping at the leaf crown because allowing the leaves to remain on the roots affects the recovery of sugar adversely.

i) Weed Control: Sugar beets are poor competitors with weeds from emergence until the sugar beet leaves shade the ground. To avoid yield loss, weeds should be totally controlled by four weeks after sugar beet emergence. A combination of cultural, chemical, and mechanical weed control methods i.e. spot spraying or hand weeding should be used to prevent establishment of weeds.

j) Harvesting: Crop sown in October-November is ready for harvest in April-May. For easy harvesting, soil should be just moist but not too wet as it causes deterioration in root quality. Sugar beet spoils fast. Hence, it needs to be transported to the mill immediately, so that it gets processed within 48 hours. Otherwise, yield and quality of sugar are adversely affected. The location of Sugar Beet Mills near the sugar beet source is, therefore, seriously important.

k) Yield Potential: Many varieties of sugar beet exist. Almost all are capable of giving yield of 30-90 tonnes or so per hectare at 10-20 % sugar content.

l) Seed production: All forms of the species B. Vulgaris are mainly cross-pollinated and intercross freely. Seed production for crops of different forms must therefore be well separated. In Pakistan, presently local seed production is not carried out because of higher cost and hence imported from Germany.

4. Usages of Sugar Beet

4.1 Industrial uses:

- Sugar beet planted commercially is mainly used for making sugar.
- Molasses of sugar beet are a rich source of Lactic Acid and vitamins, used widely in the alcohol, pharmaceuticals and bakers yeast.
- In some European countries, especially in the Czech Republic and Germany, sugar beet is also used to make rectified spirit.

4.2 Human food

- Sugar beets contain 10 to 20% sucrose. Sucrose is used widely as a pure high energy food or food additive.

- High fiber dietary food additives are manufactured from sugar beet pulp and major food processors in the United States use these dietary supplements in new products including breakfast cereals.

4.3 Beverages and syrup

- ✓ The unrefined sugary syrup can be produced directly from sugar beet. This thick, dark syrup is produced by cooking sugar beet for several hours, then pressing the resulting sugar beet and concentrating the juice produced until it has the consistency similar to that of honey. No other ingredients are used.

- ✓ In Germany, particularly in the Rhineland area, this sugar beet syrup (called Zuckerrüben-Sirup in German) is used as a spread for sandwiches, as well as for sweetening sauces, cakes and desserts.

4.4 Livestock feed & green manuring

- ❖ Sugar beet pulp and molasses are widely used as feed supplements for livestock. These products provide required stuff in rations and increase the deliciousness of feeds.

- ❖ Beet tops (leaves and petioles) also can be used as fodder. Tops are an excellent source of protein, vitamin A, and carbohydrates but are slightly inferior to alfalfa or corn silage. Beet top silage is best feed in combination with other feeds.
- ❖ The tops are also useful as green manure. Tops from one hectare add about 100 kgs nitrogen to soil.

- ❖ Leftover lime from the processing of sugar beets is an excellent soil improvement to increase soil pH levels.

- ❖ Waste lime is a good source of P & K plant nutrients.

5. World's Sugar Production

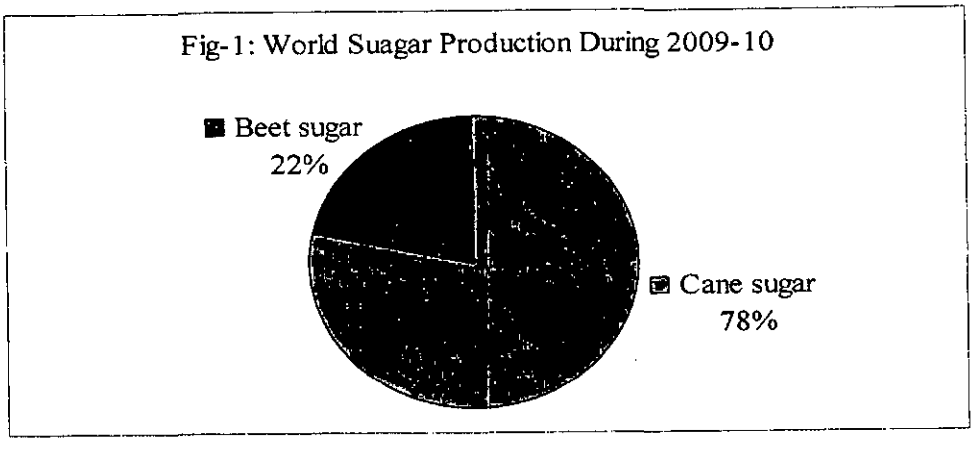
Currently sugar is produced in more than 100 countries and global production during 2009-10 has arrived at 155 million tonnes. Approximately 78 percent of sugar is produced from sugarcane and the remaining 22 per cent is produced form sugar beet. Generally, the costs of producing sugar from sugarcane are lower than the sugar processed from sugar beet.

Sugar beet is primarily a crop of the temperate region in Europe. However, advances in genetics and agro-technological improvements have extended its scope to the **subtropics** where it is cultivated as an irrigated winter crop and consequently adequate percentage of world refined sugar comes from sugar beet. According to the International Sugar Organization (ISO), reported by the Pakistan Sugar Mills Association in its annual sugar report 2010, the beet sugar production during 2009-10 placed at 33.7 million tones, nearly 22 % of the overall world sugar production of 155.0 million tonnes. The world sugar production during 2009-10 is presented in Table-1 and depicted at Fig-1.

Table-1: World Sugar Production: 2009-10

Sugar Production	Quantity	
	(Million Tonnes)	Percent
1. Cane sugar	121.302	78.24
2. Beet sugar	33.746	21.76
Total production	155.048	100.00

Source: PSMA Annual Report, 2010.



6. World 10 Largest Sugar Producers: 2009-10

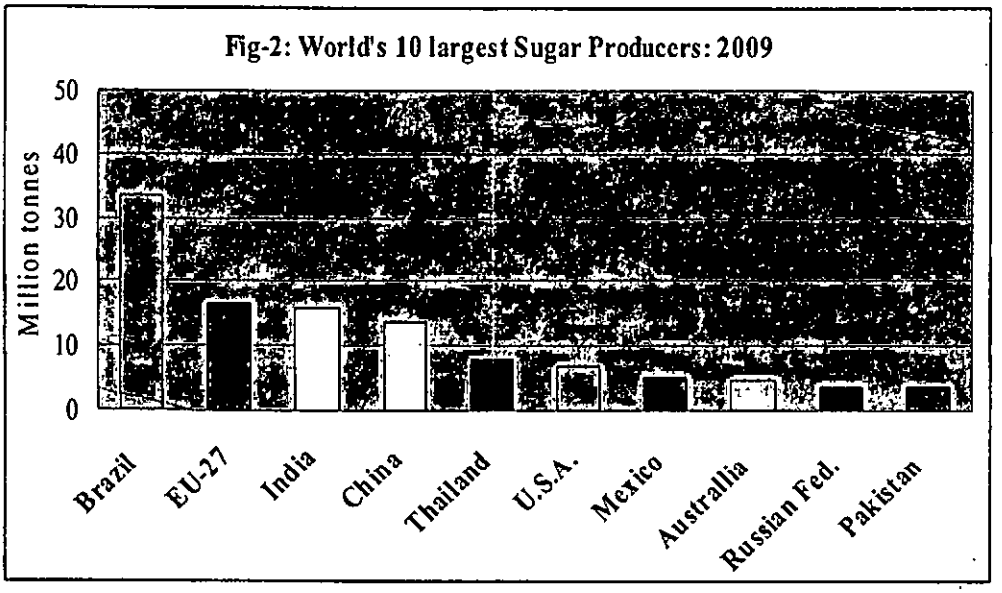
During 2009-10, the world 10 largest sugar producers contributed 110.98 million tonnes (71.6 %) of the world's total sugar production. Country wise production is given in the Table-2 and portrayed in Fig-2.

Table-2: World 10 Largest Sugar Producers: 2009-10

S. No	Country	Cane Sugar	Beet Sugar	Total
		--- Million tonnes ---		
1	Brazil	33.45	-	33.45
2	EU-27	-	16.63	16.63
3	India	15.65	-	15.65
4	China	12.85	0.78	13.63
5	Thailand	7.94	-	7.94
6	U.S.A.	2.92	3.94	6.86
7	Mexico	5.18	-	5.18
8	Australia	4.52	-	4.52
9	Russian Federation	-	3.6	3.6
10	Pakistan	3.49	0.01	3.5
	Sub-total	86	24.96	110.96
	World total	121.3	33.75	155.05

Source: PSMA Annual Report, 2010.

It is commendable to note that the three largest world producers i.e. EU-27 and Russian Federation produce their sugar exclusively from sugar beet while USA produces 57 per cent of its sugar from sugar beet.



7. Global Sugar Beet Area, Yield & Production

Sugar beet is cultivated worldwide in more than 50 countries. During 2009, global sugar beet occupied an area of 4.274 million hectares with a total production of 227.158 million tones.

Area, yield and production of 10 largest sugar beet producing countries' in the world are given in the Table-3.

Table-3: Global 10 Largest Producers' Area, Yield and Production of Sugar Beet: 2009

Area: million hect.
Yield: tonnes/hect.
Prod: million tonnes

S. No	Country	Area	Yield	Production
1	France	0.374	93.8	35.067
2	United States of America	0.465	57.6	26.779
3	Germany	0.384	67.6	25.919
4	Russian Federation	0.770	32.3	24.892
5	Turkey	0.324	53.3	17.275
6	Poland	0.200	54.3	10.849
7	Ukraine	0.320	31.5	10.068
8	United Kingdom	0.119	70.0	8.330
9	China	0.186	38.5	7.179
10	Netherlands	0.073	78.9	5.735
	Sub total	**3.215**	**53.5**	**172.093**
	World total	**4.274**	**53.1**	**227.158**
	Pakistan	**0.002**	**40.4**	**0.093**

Source: FAO STAT, 2009.

The world 10 largest sugar beet producing countries contribute 75 per cent of total area and 76 of total production. In terms of production, France is on the top with 35.07 million tones, followed by U.S.A, Germany, Russia Fed. and Turkey with 26.78, 25.92, 24.89 and 17.28 million tones, respectively. Pakistan lies at 40th number in this regard.

8. Sugar Beet Cultivation in Pakistan

In Pakistan, refined sugar is extracted/produced by the sugar mills from three sources i.e. sugarcane, sugar beet and raw sugar. Sugarcane is the main source of sugar production in the country. Our sugar industry is entirely dependent on the availability of sugarcane. However, it is a high delta crop tarnished for its extravagant water use and occupies land for 13-16 months. Whereas sugar beet has a comparative advantage as it is a low delta crop and occupies land for 4-5-months.

In Pakistan, Khyber Pakhtunkhwa has the privilege to grow sugarcane and sugar beet in the same field simultaneously since the mid-sixties. Sindh is the only other province where sugar beet is cultivated on a very stunted scale ranging between 50 to 100 hectares, while the initial technical evolution shows that agronomy wise the crop (sugar beet) can be grown as a winter crop both in lower Sindh and Punjab to be sown in October/November and harvested in April/ May after the cane crushing is over.

The long-terms changes in area, yield and production of sugarcane and sugar beet in Khyber Pakhtunkhwa is presented in Table-4 and depicted in Fig-3.

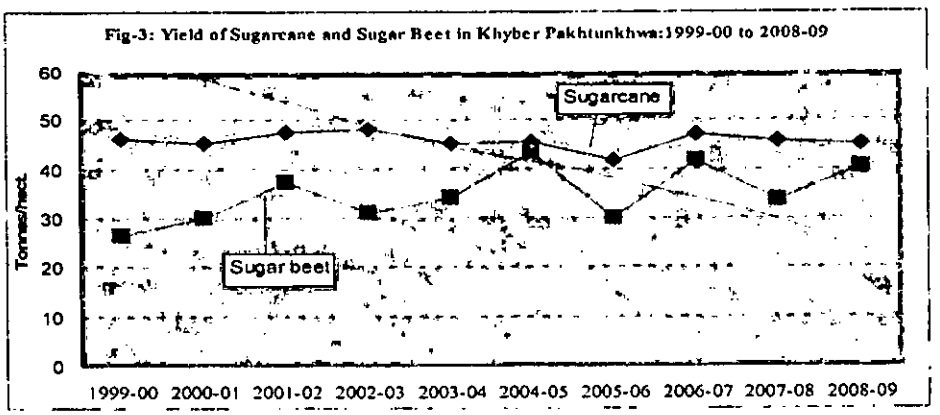
Historically, increases in sugarcane and sugar beet production have largely been dependent upon increases in acreage. The yield of sugarcane to some extent remained stagnant and showed insignificant decreasing trend of 0.4 % per annum while sugar beet yield has increased @ 3.3 % per annum. Though sugar beet yield has improved during the decade ending on 2009, nevertheless it needs further enhancement because the average yield i.e. 34.82 tonnes per hectare in Khyber Pakhtunkhwa is merely 66 per cent of the world's sugar beet average yield of 53.1tonnes/hect.

Table-4: Area, Yield and Production of Sugarcane & Sugar Beet in Khyber Pakhtunkhwa: 1999-00 to 2008-09

Year	Area (000 hect.)			Yield (Tonnes/hect.)		Production (000 tonnes)	
	Sug. cane	Sug. beet	Sug. beet as % of the sug. cane	Sug. cane	Sug. beet	Sug. cane	Sug. Beet
1999-00	106.3	6.0	5.6	46.1	26.4	4900.0	158.5
2000-01	106.0	7.5	7.1	45.3	29.9	4800.0	224.4
2001-02	101.0	8.5	8.4	47.4	37.2	4787.0	316.0
2002-03	105.0	6.9	6.6	48.1	31.1	5049.0	214.9
2003-04	105.0	7.3	7.0	45.2	34.3	4745.0	250.2
2004-05	106.0	2.8	2.6	45.4	43.2	4816.0	120.9
2005-06	98.6	3.1	3.1	41.6	30.1	4100.0	93.3
2006-07	102.0	2.0	2.0	47.1	41.8	4800.0	83.6
2007-08	104.8	1.9	1.8	45.7	33.7	4792.0	64.1
2008-09	98.2	2.3	2.3	44.9	40.4	4408.5	93.0
% Growth rate	-0.6	-16.0		-0.4	3.3	-0.9	-13.2

Note: The growth rates have been worked out by estimating the equation $Y=a(1+r)^x$ through Ordinary Least Squares (OLS) method from the data given in Annex-I.

Sources: 1. For 1999-00 to 2008-09: Agriculture Statistic of Pakistan, 2009-10.
2. For Sugar beet 2008-09: FAO STAT, 2009.



9. Cost of Production of Sugar Beet

As per cost estimation calculated by the Sugar Crops Research Institute, Mardan, the cost of arising one acre of sugar beet during 2010-11 crop season in Khyber Pakhtunkha is Rs 40464, inclusive of land rent. Distributing the cost of production over the average yield of 500 maunds (40 kgs each), the cost of production of sugar beet at the farm level comes to Rs 80.93 per 40 kgs. Adding the marketing incidentals, including road cess @ Rs 11.70 per 40 kgs, the cost of sugar beet at mill-gate comes to Rs 92.83 per 40 kgs. The detailed cost of production of sugar beet for the year 2010-11 crop is given in the Table-5.

Table-5: Average Farmers' Cost of Production of Sugar Beet in Khyber Pakhtunkhwa: 2010-11 Crop

S.No.	Operation/input	Avg. No. of oprs/units/ acre	Cost per Unit	Cost per Acre
			---- Rupees --	
1	Land preparation:			
	Deep ploughing (hrs)	2	700	1400
2	Seed bed preparation:			
	2.1 Harrowing (hrs)	1	600	600
	2.2 Leveling ploughing (hrs)	2	600	1200
	2.3 Ridge making	1	600	600
	2.4 Plotting (m. days)	2	200	400
3	Cost of Seed (kgs)	2	570	1140
4	Sowing (m.days)	8	200	1600
5	Fertilizers: (bags)			
	5.1 Urea	2	1100	2200
	5.2 DAP	2	3100	6200
	5.3 Transportation	4	15	60
	5.4 Application Charges (m.days)	2	200	400
6	Irrigation Charges:			
	6.1 Canal	-	-	264
	6.2 Labour Charges (m.days)	8	200	1600
	6.3 Cleaning water channel (m.days)	2	200	400
7	Plant Protection: (Nos)			
	For grass hoppers, aphids and cut worms control	3	500	1500
8	Interculture:			
	8.1 Weedicides & fungicide (Rs/acre)	-	-	1500
	8.2 Hoeing with Kudal (m.days)	8	200	1600
9	Land rent for 6 months (Rs/acre/annum)	-	30000	15000
10	Harvesting charges (m.days)	8	200	1600

11	Management charges (50 acre farm managed at @ Rs.5000/- per month)	-	-	1200
12	Gross cost of production	-	-	4046
13	Yield (40 kgs/acre)	-	-	500
14	Cost of production at farm level (Rs 40/kgs)	-	-	80.93
15	Marketing charges (Rs/40 kgs)			10.7
	15.1 Loading and unloading charges (8 m.days per acre)	-	-	3.20
	15.2 Transportation charges @ Rs15/100 kgs	-	-	6.00
	15.3 Road cess @ Rs 0.50/40 kgs	-	-	0.50
	15.4 Misc. charges @ Rs 500/truck of 250 mnds load	-	-	2.00
16	Cost of Production at sugar mill gate:			
	16.1 Including land rent	-	-	92.63
	16.2 Excluding land rent	-	-	62.63

Source: Sugar Crops Research Institute, Mardan.

The chief component of the cost of cultivation of sugar beet in KPK during 2010-11 crop year is land rent, accounting for 37 per cent. The other important ingredients are: Fertilization (22 %), land preparation (10 %), interculturing (8 %), Seed and sowing operations (7 %) and irrigation (6 %).

10. Support/Indicative Prices of Sugarcane and Sugar Beet

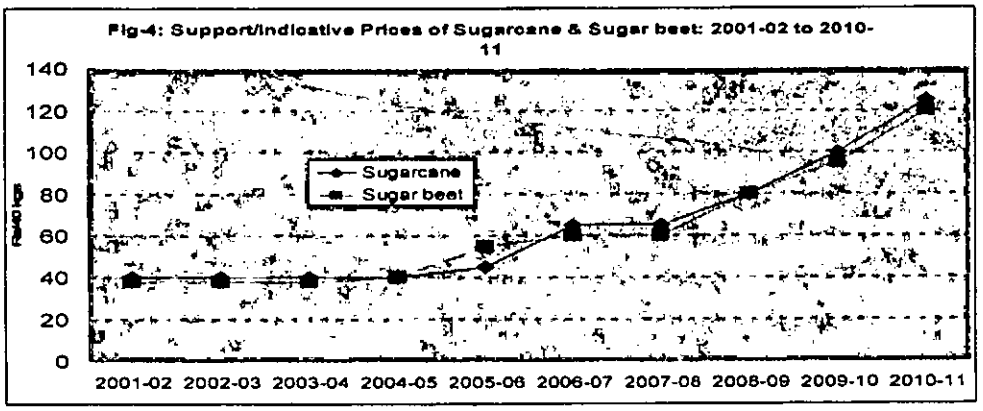
The Agriculture Policy Institute (API), Islamabad annually works out cost of production of different crops and makes price recommendations to the federal government to set minimum price of the respective crop. In case of sugarcane and sugar beet, the Federal government authorizes provincial governments to fix respective crop prices in consultation with representatives of both the sugar industry and farmers' organizations. Since cost calculation and thereafter minimum prices of sugarcane and sugar beet are done by the provincial government of Khyber Pakhtunkhwa. The minimum prices of sugarcane and sugar beet during last 10 years are given in Table-6 and portrayed in Fig-4.

Table-6: Support/Indicative Price of Sugarcane & Sugar Beet: 2001-02 to 2010

Year	Price (Rs/40 kgs)	
	Sugarcane	Sugar beet
2001-02	40	38
2002-03	40	38
2003-04	40	38
2004-05	40	40
2005-06	45	55
2006-07	65	60
2007-08	65	60
2008-09	80	80
2009-10	100	95
2010-11	125	120
% growth rate	**14.23**	**14.12**

Sources: 1. For Sugarcane: PSMA, Islamabad.
2. For Sugar beet: Director Food/Cane Commissioner, Khyber Pakhtunkhwa.

The tendencies in Support/Indicative prices of the sugarcane and sugar beet are more or less equal with trifling differences between the support/indicative prices and are estimated to increase @ 14.23 and 14.12 per cent per annum, respectively. However, it has been learnt that there generally exists a vast difference between the market prices realized by the growers of both crops. For example, during 2010-11 crop year, the sugarcane growers received **Rs 200-275/40 kgs, higher by 60-120 % than the announced indicative prices of Rs. 125/40 kgs**, whilst the sugar beet growers were given **Rs. 130/40 kgs, higher by 4 % only against the announced minimum indicative price of Rs 120/40 kgs.**



11. Demand and Supply of Sugar in Pakistan

The country is one of the world's 10 largest Sugar producers. Sugar consumption (demand) in Pakistan is growing with the expanding population and rises in per capita income and has arrived at 4.186 million tones in 2009-10 while the domestic production (supply) remained at 3.138 million tones, less by 25 per cent than the consumption. During the decade ending on 2010, domestic sugar production grew @ 2.61 % per annum while consumption grew @ 2.92 percent per annum with per capita sugar consumption of about 24 kilograms a year. If the consumption of non-centrifugal sugars (gur, ---) were added, apparent consumption would be much higher. The consumption of gur is difficult to track since there is a large amount of unrecorded trade along the borders of Afghanistan and the Islamic Republic of Iran.

The domestic sugar production (from sugar cane and sugar beet) and sugar consumption during 1999-00 to 2009-10 is given in Table-7.

Table-7: Domestic Sugar Production and Consumption in Pakistan: 1999-00 To 2009-10

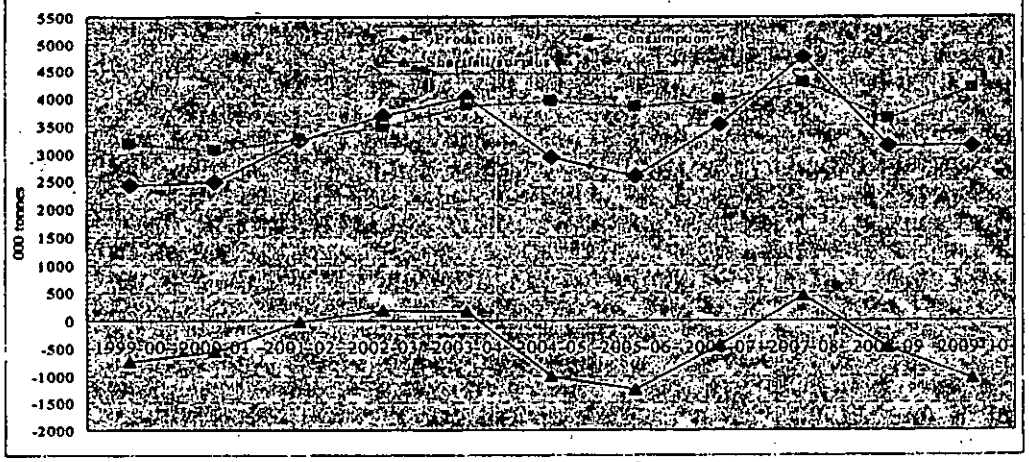
Sugar Made= 000 Metric Tonnes

Year	Sugarcane		Sugar beet		Total	Share		Sugar Consumption		Shortfall/surplus	
	Sugar Made	Recovery (%)	Sugar Made	Recovery (%)		Sugarcane	Sugar beet	per capita (Kgs)	000 tonnes	000 tonnes	Percent
						Per cent					
1	2	3	4	5	6= 2+4	7	8	9	10	11=10-6	12=6/10*100
1999-00	2414.7	8.33	14.6	7.80	2429.3	99.40	0.60	23.3	3172.0	-742.7	-23.41
2000-01	2466.8	8.39	17.3	7.64	2484.1	99.30	0.70	21.8	3055.0	-570.9	-18.69
2001-02	3197.8	8.71	39.1	9.23	3236.9	98.79	1.21	22.7	3252.0	-15.1	-0.46
2002-03	3652.7	8.74	22.1	9.94	3674.8	99.40	0.60	23.9	3483.0	191.8	5.51
2003-04	3997.0	9.15	23.8	9.51	4020.8	99.41	0.59	25.9	3855.0	165.8	4.30
2004-05	2922.1	9.10	11.4	9.41	2933.5	99.61	0.39	25.8	3941.0	-1007.5	-25.56
2005-06	2588.2	8.60	8.9	9.55	2597.1	99.66	0.34	25.1	3846.0	-1248.9	-32.47
2006-07	3516.2	8.69	7.9	9.04	3524.1	99.78	0.22	24.3	3958.0	-433.9	-10.96
2007-08	4740.9	8.98	5.5	8.80	4746.4	99.88	0.12	25.8	4297.0	449.4	10.46
2008-09	3134.1	9.46	0.9	10.55	3135.0	99.97	0.03	21.3	3628.0	-493.0	-13.59
2009-10	3133.5	9.05	4.6	9.15	3138.1	99.85	0.15	24.1	4186.00	-1047.9	-25.03
% growth rate	**2.70**	**0.83**	**-21.43**	**1.61**	**2.61**	**0.08**	**-23.43**	**0.43**	**2.92**	-	-

Source: PSMA Annual Report, 2010.

The data given in the Table-7 reveals that the domestic supply of sugar remained short of the demand throughout in the referenced period except three years i.e. 2002-03, 2003-04 and 2007-08. Despite efforts to achieve self sufficiency, Pakistan remains a net importer of sugar. Domestic production is augmented by imports to bridge the gap in supply and demand.

Fig-5: Domestic Sugar Production, Consumption and Shortfall/Surplus: 1999-00 to 2009-10



12. Conclusion

Pakistan's agriculture has been suffering off and on from severe shortage of irrigation water. This situation has caused a major set back in agriculture. The crop farming is relying more and more on the ground water which on one hand is not suitable for irrigation due to higher intensity of unwanted salts in many areas which causes several land degradation issues and on the other hand it costs more due to higher fuel and energy costs. This situation has cost a significant raise in the cost of production of all agriculture commodities..

In Pakistan, the average per capita consumption of sugar is about 24 kgs a year which is approximately equal to the world's sugar consumption of 23.8 kgs in 2009-10 (Food Outlook - June 2011) but higher than the neighboring sugar producing countries' per capita consumption of India and China of 19 and 10 kgs per annum, respectively. During the decade ending 2010, the consumption of sugar in the country increased @ 2.92 percent per annum a result of growth in population and improvement in the per capita income while domestic sugar production escalated @ 2.61 per, lesser by about 11 percent of the consumption requirement. The domestic sugar production was augmented by imports to bridge the gap in supply and demand which hugely cost national exchequer of foreign exchange.

The Pakistan milling sector has grown from 2 mills after World War II to 83 mills (2009-10). Industry's total sugar production capacity is 6 million tones. At present, capacity utilization is estimated 60-70 per cent depending upon sugarcane availability, based on 80 % crushing and 8.9 % sugar recovery rate. Even with overriding efforts of sugar mills to acquire cane, cane supply for every sugar mill is low and as a result runs underutilization alongwith low extraction rate due to deteriorated cane quality.

According to Federal Agriculture Policy Research Institute, U.S. (FAPRI) projections (2008-2016), Pakistan under the water shortage and land degradation circumstances will not be able to produce sufficient amount of sugar from sugar cane in the coming years and will be importing about 1 million tonnes of sugar annually which will not only be a huge financial liability on the national exchequer but also an emerging threat to the sugar industry and related beneficiaries i.e. mainly farmers and indirect stake holders in the country.

Keeping in view the facts, the area under sugarcane in Pakistan can not be increased beyond the level which is about 1 million hectare due to competition with cereal as well as other valuable cash crops. The only possibility is to increase the yield and sugar contents of the sugarcane per acre through research and development. But during the last several years the improvement in yield had not been so significant and it is feared that this status quo situation would likely to continue.

Meeting with low production of sugar and its increasing demand in the country, dissemination of sugar beet, a Supplement to Sugarcane for sugar production in Pakistan is an appropriate solution. The Sugar beet, low delta crop (27 acre inches) of short duration (5 to 6 months) with irrigation requirements of 6-8 times compared to 25-30 irrigations required by sugarcane high delta crop (46 acres inches) can produce almost two times higher sugar yields per hectare, if the government along with the sugar industry would set longer-term objectives and make appropriate arrangements for the promotion of the crop.

13. Recommendations

The sugar beet cultivation is not successful unless there is a buyer. As the sugar mills are the key players in the chain that offer a market for the sugar beet crop to process it for sugar production. But the sugar mills are reluctant to make investment in modification of the existing mills due to lack of confidence on crop agronomy, sufficient raw material availability, fuel shortage and lack of expertise & technology. In wake of declining sugar production and water shortage in the country, the following measures are recommended for promotion of sugar beet as a

supplement to sugarcane for sugar production, its industrial adoption and commercialization:

a) The govt. should devise a sugar beet development policy with incentives like duty free import of both new and second hand sugar beet plants, provision of beet seeds, easy access of sugar beet growers to soft loan;

b) The federal & provincial agriculture departments should devise Beet Production Technology for each region to conduct large scale trails on different agronomic aspects to come up with an appropriate technology for each area depending on soils and water quality issues;

c) Encourage farmers to first sow beet on trail basis by offering them subsidized/free farm inputs & crop insurance to build their confidence in the crop;

d) To reduce the higher costs incurred on sugar beet processing on account of external source of energy because of non-availability of bagasse:

e)
   i) Up-gradation of stem consumption of sugar mills to save energy source through use of local coal;
   ii) To explore potential market for sugar beet pulp in the country as there is sufficient number of milking and meat animals.

f) Ensure sugar beet growers a guaranteed price for their produce;

g) There should be a pre-arrangement between sugar mills and farmers to ensure that sugar mills will purchase beet produce on harvest;

h) The government should give incentives to the mills in form of waiving all duties and taxes on sugar made from beet;

i) Agriculture Research Institute should develop quality beet seeds for different climate areas;

14. References:

i) Pakistan Sugar Mills Association.
ii) Sugar Crops Research Institute, Mardan.
iii) Director Food/Cane Commissioner, Khyber Pakhtunkhwa.
iv) Small Medium Enterprises Development Authority (SMEDA)
v) Food Outlook, June 2011.
vi) World of Sugar, Annual Report 2010, Part-6.

was attributed to high world prices, overall increase in prices of purchased inputs and crop cultivation operations. Increase in prices of agricultural inputs/ cost of production and intervention price affects economic efficiency in the production of a crop. Most common measures of economic efficiency are Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC) and Domestic Resource cost Coefficient (DRC). These indicators are estimated with the help of crop specific economic and social costs and respective revenues.

The purpose of this paper is assessment of the effect of increase in reference price of the above said crops on indicators of economic efficiency and comparative advantage.

The paper consists of 4 sections. Section 2 succeeding this introductory section presents analytical procedures. Section 3 describes the data analysis and discussion while in Section 4 we offer our conclusion and recommendation.

2. Analytical procedures

There are four major crops of Pakistan. These are wheat, seed cotton, rice and sugarcane. However, this paper does not include sugarcane and for this paper economic efficiency of wheat, rice and seed cotton is assessed in terms of Nominal Protection Coefficient, Effective Protection Coefficient and Domestic Resource Cost Coefficient. Critical values of these coefficients are estimated on the basis of respective crop revenues; cost incurred on traded inputs and expenditure made for domestic factors. The above referred coefficients are estimated as below:

2.1 Nominal Protection Coefficient (NPC)

NPC is generally defined as the price of the crop prevailing in the open market divided by its social price. For the purpose of analysis in this paper, social price is assumed as import parity price received by the growers.

2.2 Effective Protection Coefficient (EPC)

A well accepted definition of EPC is the difference of crop revenue estimated on the basis of open market price and cost of traded inputs (seed, fertilizer, pesticides, tractor and tube-well). For EPC, cost incurred on traded inputs estimated on the basis of open market prices are divided by the difference of crop revenues calculated on the basis of social price and cost of traded inputs calculated on the basis of social prices

2.3 Domestic Resource Cost Coefficient

DRC is domestic factor cost at social prices divided by the difference between the crop revenue and cost of traded inputs at social price.

Domestic factor cost includes expenditure incurred on hired labour, mark-up on capital employed in the production of a particular crop, farm yard manure, transportation of inputs and farm produce, canal water, management of the crop since sowing up to disposal, land rent, land revenue tax and land tax.

3. Data Analysis and Discussion

For measuring economic efficiency of the selected crops primary data on cost of production of the subject crops are obtained from various issues of the price policy analysis reports of the Agriculture Policy Institute, 2009-10 through 2010-11. Data findings are explained in the following paragraphs.

3.1 Reference price and Nominal Protection Coefficient NPC

NPC

Data in Table-1 is produced to study the effect of rise in reference prices[1] of wheat, rice and cotton made for the 2008-09 crops. It is already mentioned somewhere else that above estimate are based on the private (open market) and social prices.

It is inferred from the data in Table-1 that increase in reference price affects Nominal Protection Coefficient differently in different crops. It is supported by the data in Table-2. Bottom row of this Table-2 indicates that among the selected crops the least raise (44% of the previous three years' average reference price) was given to cotton. Consequently NPC improved from 0.95 to 1.10 for Punjab and from 0.93 to 1.08 for the Sindh province (Table-1). But this relationship was not maintained in case of rice. Because the reference price for Basmati paddy was increased by 151% and for IRRI paddy by 126% of the benchmark average price given in row 1 of Table-2 but NPC value for both varieties declined rather improve. However, wheat crop responded differently. Its NPC positively changed in 2008-09 after increase in the intervention price.

EPC

The conclusion derived for NPC also holds true for Effective Protection Coefficient. Despite that intervention price of seed cotton was relatively increased

[1] In Pakistan, Government announces intervention price for rice paddy and seed cotton and; procurement price for wheat. For the purpose of simplicity in this paper these both categories are referred as reference price.

less than rice (Table-2) but EPC for seed cotton increased while it stagnated for Basmati rice and declined for IRRI paddy (coarse rice) from 0.75 to 0.71 (Table-1). Again EPC significantly increased for wheat whose reference price was increased relatively less than rice (Table-2).

As a rule of thumb EPC less than one suggests taxation to the growers and greater than one protection to the growers of a crop. It may be observed from Table-1 that EPC estimates for rice and wheat are less than one. Consequently it may be stated that in Pakistan despite significant increase of intervention prices cotton and rice growers are heavily taxed. Another important finding emerging from the analysis is that irrespective government procures the produce of a crop or not, local market for cotton is more functional than rice.

Table-1 NPC, EPC and DRC estimates for wheat, rice paddy and seed cotton crops: 2005-06 through 2008-09

Crop / Year	NPC value		EPC value		DRC value	
	Average of 2005-06 to 2007-08	2008-09	Average of 2005-06 to 2007-08	2008-09	Average of 2005-06 to 2007-08	2008-09
1. Wheat (Punjab province)	0.63	0.91	0.46	0.89	0.39	0.38
2. Wheat (Sindh province)	0.63	0.91	0.37	0.74	0.31	0.29
3. Basmati paddy (Punjab province)	0.74	0.71	0.63	0.64	0.52	0.42
4. IRRI paddy (Sindh province)	0.81	0.76	0.75	0.71	0.6	0.54
5. Seed cotton (Punjab province)	0.95	1.1	0.87	1.17	0.69	1.03
6. Seed cotton (Sindh province)	0.93	1.08	0.89	1.14	0.61	0.93

Notes: - Basmati and IRRI are fine and coarse rice varieties vastly cultivated in Pakistan.

- Coefficients for seed cotton and rice are estimated under export scenario while for wheat under import scenario because Pakistan is a net exporter of cotton and rice and occasional importer of wheat

DRC

As DRC indicates the opportunity cost of domestic resources employed in the production of a crop (Ahmed, M.1 2011). DRC value less than one indicates a commodity's comparative advantage and the Vice Versa. The DRC estimates in Table-1 are consistent with NPC and EPC estimated values. DRC value for seed cotton improved significantly while it declined for rice. Unlike NPC or EPC, DRC value declined for wheat. DRC estimates indicate that Pakistan has comparative

advantage in all three crops. It is beneficial to produce wheat, cotton and rice locally rather import because their domestic prices are less than the equivalent international prices.

Table-2 Nominal reference prices of wheat, rice and seed cotton in Pakistan

(Rs./40 Kg)

Year		Reference price			
		Wheat	Basmati paddy	IRRI Paddy	Seed cotton
1.	Average reference price during 2005-06 through 2007-08	488	598	310	1017
2.	Reference price in 2008-09	950	1500	700	1465
3.	Raise given in 2008-09 over average price for 2005-06 through 2007-08	95%	151%	126%	44%

3.2 Cost of production and economic efficiency coefficients

Varying crop response in efficiency terms may be influenced by respective cost of production of a crop. Thus it necessitates examination of the relationship between the referred parameters of economic efficiency and cost of production. Crop specific data on cost of production is produced in Table-3 which is described in relation to intervention prices in Table-2. It is inferred from Table-3 that cost of production of wheat, basmati rice, IRRI rice and seed cotton increased in 2008-09 over average of the period 2005-06 through 2007-08 by 49, 32, 39 and 30 per cent respectively. This increase in comparative terms is less than the corresponding increase in reference prices. This indicates that increase in cost of production does not affect economic efficiency parameters. This situation calls for exploring further to identify other factors affecting economic efficiency in the production of different crops in Pakistan.

Table-3 Cost of production (COP) of wheat, rice and seed cotton in Pakistan

(Rs./40 Kg)

Year		Reference price			
		Wheat	Basmati paddy	IRRI Paddy	Seed cotton
1.	Average COP during 2005-06 to 2007-08	443	599	270	966
2.	COP during 2008-09	658	767	376	1252
3.	Increase in 2008-09 over average COP of 2005-06 to 2007-08	49%	32%	39%	30%

4. Conclusion and recommendation

Pakistan wheat and rice growers are implicitly taxed as the respective NPC and EPC values calculate less than one. Despite that intervention prices of wheat, rice and seed cotton are significantly increased parameters of economic efficiency did not change across the board. For this a potential explanation is that intervention price does not improve economic efficiency in all crops alike. The situation indicates as if there are some factors other than indicative price or cost of production that affect major crops' economic efficiency and comparative advantage. It is recommended to conduct further research on this topic to explore those factors which affect economic efficiency and comparative advantage.

References:

1. Wheat Policy Analysis for 2009-10 Crop. Agriculture Policy Institute, Ministry of Food and Agriculture, Government of Pakistan, Islamabad.

2. Cotton Policy Analysis for 2010-11 Crop. Agriculture Policy Institute, Ministry of Food and Agriculture, Government of Pakistan, Islamabad.

3. Rice Paddy Policy Analysis for 2009-10 Crop. Agriculture Policy Institute, Ministry of Food and Agriculture, Government of Pakistan, Islamabad.

4. Ahmed M.I, Economic Efficiency of Resource Use in Rice Production in Pakistan; Pakistan Journal of Agricultural Economics, Volume 7, May 2011, Islamabad.