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**IMPORT BARRIERS  
FOR  
AGRICULTURAL  
INPUTS**

David Gisselquist

This occasional paper is a product of the joint UNDP/World Bank Trade Expansion Program which provides technical and policy advice to countries intending to reform their trade regimes. The views contained herein are those of the authors and do not necessarily reflect those of the United Nations Development Program or the World Bank.

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# **Import Barriers for Agricultural Inputs**

**David Gisselquist**

**May 1994**

**Trade Policy Division  
The World Bank  
Washington, DC**

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# 1

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## *Introduction*

**M**odern agriculture, like other industries, depends heavily on tradable inputs. One of the greatest challenges in agricultural development is getting technology and new products that will boost yields into the hands of farmers.

This paper describes tariff and non-tariff import barriers on seeds and fertilizers in World Bank client countries<sup>1</sup>; shows that such barriers block private introduction of new agricultural technology and slow agricultural growth; and proposes reforms for governments and donors to promote private technology transfer.

### **Technology transfer and research**

Each farmer moves along the continuum from traditional to modern agriculture by changing his or her technology, which almost

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always entails change in inputs. Even in traditional settings, farmers are aware of many technological options — crops, varieties, pest control measures, etc. — learning and choosing among options while they farm. But often the options for farmers in developing countries are limited, not allowing them to achieve yields and incomes that farmers in developed countries are able to achieve with better technology.

Some of the difference in average yields could be reduced by making available to farmers in developing countries technology that is already available in other countries around the world. Much agricultural technology is internationally applicable, including fertilizers, pesticides, some animal breeds, and agricultural machinery. Many improved plant varieties have been successfully introduced into multiple countries.

But not all yield differentials between countries can be closed through technology transfer. Specific conditions in one country may require modifications or even new technologies, for example, new plant varieties. Many studies show high returns to money spent on agricultural research. Given the public goods nature of some agricultural technology, strong arguments can be made for public as well as private spending for agricultural research.

*Technology transfer and research:  
complementary processes*

Experts in agricultural development have at times debated the relative importance of technology transfer and research for today's developing countries. The argument

misleadingly suggests that technology transfer and research are competing activities. A recent study of Indian industry reports:

... most of the empirical literature directly contradicts the presumption that technology imports and indigenously generated technology are substitutes. If anything, the relationship that is observed is one of complementarity (Deolalikar and Evenson, 1990, p 251).

Complementarity applies for agricultural as well as industrial technology. Research in agriculture in developing countries is largely adaptive, feeding on imported technology.

Returns to research depend in part on the speed with which new technology is disseminated to farmers in the form of new inputs and information and also on the number of farmers to whom the technology is distributed. Improving technology transfer raises returns to research. For example, other things equal, gains from research that are distributed to 500 million farmers in five years give higher returns than the same gains distributed to 100 million farmers in 10 years.

Government policies limiting technology transfer across international boundaries inhibit investment in regional research. For example, private seed companies may lose interest in investing in research for regions of Latin America or Africa if new varieties cannot be sold across national boundaries — for example, from Zimbabwe to Tanzania. Similarly, benefits to farmers and consumers from research in international agricultural research centers (IARCs) are also constrained by trade barriers blocking private sector import and introduction of inputs embodying IARC technology.

*Choosing both: more technology transfer and more research*

As discussed in this paper, many governments go out of their way to obstruct private imports of agricultural inputs that embody new technologies. It costs governments nothing to relax non-tariff import barriers on agricultural inputs.<sup>2</sup> Furthermore, insofar as removing trade barriers promotes private trade, governments may cut back expensive public sector programs to distribute agricultural inputs, leaving more money for other program options. The recommendation that governments "open the door and get out of the way" leaves funding for other policy and program options, such as public sector research and extension, to be debated on their own merits.

Removing non-tariff barriers on private imports of agricultural inputs may be expected, in time, to lead to more public and private sector agricultural research. As argued above, improving technology transfer boosts returns to agricultural research, encouraging private companies to pay for more research in developing countries and justifying larger budgets for IARCs. Also, as private sector technology transfer raises the level of technological sophistication among farmers and traders in developing countries, public sector scientists may find more demand for their services to advise farmers, traders, and government officials.

*Technology for larger and smaller countries*

The size of national markets for agricultural inputs varies tremendously by country.

During 1982 to 1984, for example, aggregate pesticide use (tons of active ingredients) in Burundi, the Gambia, and Uganda was less than 10 percent pesticide use in Kenya, Uruguay, and Tunisia, which was less than 10 percent pesticide use in Algeria, Thailand, and Colombia, which was less than half pesticide use in India, China, or Brazil (World Resources Institute 1992, p 274). Similar statistics on relative size of national markets could be presented for seeds, fertilizers, and other inputs.

Public and private investments in research in any developing country depend on market size and government budget, both of which vary tremendously across countries. A recent World Bank report comments: "Most African countries are too small to afford the agricultural research they need." (World Bank 1989, p 99) While some of the larger developing countries have hundreds of PhD scientists in public sector agricultural research and offer large markets that attract private research, smaller countries depend more heavily on trade and technology transfer.

**Import reform issues: an overview**

Many cross-country studies find correlations between openness and growth. Recent theoretical and statistical analyses by Romer propose a causal link: "Increases in openness to international trade do seem to cause increases in the rate of technological change" as potential investors gain access to "the broad range of highly developed producer inputs available world wide" (Romer 1989, pp 2, 34). Romer's work suggests that agricultural growth may be more effectively

Table 1.1: Imports of agricultural inputs, 1990  
(millions of U.S. dollars, unless otherwise noted)

Region and Country	crude fertilizers	manufactured fertilizers	pesticides	agricultural machinery	seeds **	total inputs	agricultural inputs as a percentage of all imports
<i>Africa</i>							
Angola		6.9	1.8	9.5		18.0	1.0
Burkina Faso	0.0	6.2	7.5	1.7		15.0	2.8
Burundi		2.1	4.2	0.3		6.6	3.5
Cameroon	0.5	2.2	30.0	13.0		45.0	3.3
Chad	0.0	1.4	6.0	3.8		11.0	2.3
Cote D'Ivoire	0.2	11.0	10.0	6.7		28.0	1.7
Ethiopia	0.1	32.0	11.0	14.0		57.0	5.3
Ghana	0.1	6.9	9.0	45.0		61.0	4.9
Guinea		0.3	0.2	0.4		0.9	0.2
Kenya	0.0	38.0	45.0	34.0		120.0	5.0
Madagascar	0.0	3.3	5.5	6.4		15.0	3.1
Malawi	0.3	5.6	2.5	3.9		12.0	2.1
Mali	0.0	3.8	6.5	4.5		15.0	3.1
Mozambique		0.8	4.0	4.0		8.8	1.0
Niger		1.0	2.2	3.0		6.2	1.5
Nigeria	0.0	58.0	14.0	73.0		140.0	2.5
Rwanda		2.1	3.4	2.5		8.0	2.8
Senegal	0.0	4.0	3.0	5.2		12.0	0.9
Somalia	0.0	1.0	0.5	4.4		5.9	1.6
South Africa	6.1	39.0	56.0	130.0		240.0	1.4
Sudan	0.0	15.0	42.0	46.0		100.0	8.0
Tanzania	0.0	16.0	18.0	15.0		49.0	3.6
Uganda	0.0	0.2	3.3	7.8		11.0	1.8
Zaire	0.0	2.4	5.4	15.0		23.0	2.9
Zambia	0.1	28.0	5.0	9.8		42.0	4.0
Zimbabwe	0.3	14.0	28.0	16.0		58.0	4.5
<i>Middle East and North Africa</i>							
Algeria	0.0	27.0	5.0	87.0		120.0	1.2
Egypt	0.0	160.0	180.0	69.0		410.0	4.4
Iran	8.0	290.0	90.0	38.0		430.0	2.7
Iraq	0.0	2.5	5.0	0.4		7.9	0.1
Morocco	0.2	53.0	30.0	49.0		130.0	1.9
Syria	0.0	46.0	14.0	26.0		86.0	3.4
Tunisia	0.0	3.6	6.0	15.0		25.0	0.4
Yemen							
<i>South Asia</i>							
Afghanistan		32.0	0.1	0.8		33.0	2.1
Bangladesh	7.0	86.0	10.0	4.7		110.0	3.4
India	130.0	980.0	22.0	12.0		1100.0	4.7
Nepal		20.0	0.5	0.8		21.0	3.1
Pakistan	12.0	200.0	90.0	70.0		370.0	5.3
Sri Lanka	1.5	65.0	13.0	8.9		88.0	3.3

<i>East Asia and the Pacific</i>						
Cambodia		0.1	0.2	0.3	0.6	
China	440.0	2700.0	290.0	39.0	3500.0	5.6
Indonesia	79.0	96.0	10.0	48.0	230.0	1.1
Republic of Korea	94.0	110.0	16.0	140.0	350.0	0.5
Malaysia	20.0	190.0	38.0	24.0	270.0	1.1
Myanmar	0.0	5.1	2.5	3.1	11.0	0.9
Philippines	42.0	120.0	31.0	9.9	200.0	1.7
Thailand	0.4	430.0	130.0	270.0	830.0	2.6
Viet Nam		140.0	1.4	2.8	150.0	14.0
<i>Latin American and the Caribbean</i>						
Argentina	0.6	27.0	65.0	18.0	110.0	2.7
Bolivia	0.0	1.4	4.5	14.0	20.0	2.8
Brazil	5.0	270.0	30.0	4.7	310.0	1.5
Chile	1.7	110.0	51.0	35.0	210.0	2.8
Colombia	2.0	130.0	40.0	35.0	210.0	3.7
Cuba	0.3	88.0	75.0	100.0	270.0	3.4
Dominican Republic	0.0	23.0	10.0	7.3	41.0	2.3
Ecuador	1.7	37.0	38.0	24.0	100.0	5.4
El Salvador	0.5	45.0	15.0	4.0	65.0	5.1
Guatemala	0.5	41.0	25.0	12.0	79.0	4.8
Haiti	0.0	1.1	2.1	1.5	4.7	1.7
Honduras	0.5	23.0	30.0	13.0	67.0	6.0
Mexico	63.0	38.0	30.0	130.0	261.0	0.8
Peru	0.1	41.0	20.0	33.0	94.0	2.7
Venezuela	3.8	47.0	7.4	29.0	88.0	1.3
<i>Europe and Central Asia</i>						
Azerbaijan						
Belarus						
Bulgaria	30.0	62.0		65.0	160.0	4.2
Czech Republic						
Georgia						
Hungary	9.2	50.0	120.0	170.0	340.0	3.9
Kazakhstan						
Poland	170.0	63.0	150.0	160.0	540.0	6.5
Portugal	9.1	53.0	73.0	210.0	340.0	1.4
Romania	130.0	60.0	38.0		230.0	2.5
Russian Federation						
Slovak Republic						
Tajikstan						
Turkey	33.0	250.0	61.0	6.2	350.0	1.6
Ukraine						
Uzbekistan						
former Czechoslovakia	16.0	120.0	100.0	160.0	390.0	3.0
former USSR	0.0	7.0	600.0	1700.0	2300.0	1.1

\* Total inputs and inputs as share of all imports are calculated for data available. Some data is for years other than 1990

\*\* Comparable data on seed imports are not readily available. Seeds are a relatively minor import.

Sources: FAO, *Trade Yearbook 1990* (Rome: FAO, 1991); IMF, *Direction of Trade Statistics Yearbook 1992* (Washington, D.C.: IMF, 1992); Technical Center for Agricultural and Rural Development (CTA), *Seed Programmes in ACP Countries* (Wageningen: CTA, 1991).

promoted with trade reform programs that address barriers to inputs trade as well as output trade.

Across World Bank client countries, the value of agricultural inputs as a share of the value of all merchandise imports seldom exceeds five percent (see table 1.1). Therefore, the aggregate value of imports is not an obstacle to reform. Even a very successful trade liberalization that brings large percentage increases in imports of agricultural inputs does not pose a macroeconomic threat, such as major increases in aggregate demand for foreign exchange. Furthermore, faster agricultural growth with more inputs can be expected to boost export earnings and cut imports of agricultural products. If access to foreign exchange is nevertheless considered to be an issue, donors granting and lending

foreign exchange are in a strong position to encourage import liberalization for inputs.

Some agricultural inputs — fertilizers, farm machinery, and vitamins and minerals for livestock feed — require no special trade controls to limit negative externalities or to protect public health. Trade in these items may be liberalized with techniques for general trade reforms — for example, taking them off import control lists and cutting tariffs.

For those agricultural inputs — seeds, pesticides, cattle and chicks for breeding, veterinary medicines — that threaten externalities and public health impacts, special controls can be maintained. Even countries with liberal import regimes control imports of these items. For such inputs, trade liberalization involves redesigning import controls to focus on externalities.



# 2

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## ***Restraints on Seed Trade***

**N**on-tariff barriers severely restrain seed trade in many developing countries.<sup>3</sup> A 1987 study of the seed industry reported:

Obstacles to trade are pervasive in seed markets by comparison with manufactured goods and other agricultural inputs and products... The exclusionary effect of trade barriers and market distortions is strongest in the developing countries (McMullen 1987, p 242-43).

Seed imports may threaten negative externalities, justifying special import controls. Import liberalization for seeds cannot, therefore, be accomplished by removing seeds from import control lists. Reform involves redesigning trade restrictions to focus on externalities. This means:

- relaxing limits on varieties of seed allowed for import and trade, accepting restrictions only for varieties which threaten negative externalities; and

- drafting and enforcing plant quarantine rules that interfere with seed trade no more than necessary to protect against realistic pest and disease threats.

### Changes in seed trade with development

#### *Accelerating the flow of new varieties to farmers*

For farmers in any country, speed of access to the continuous stream of new plant varieties being turned out by public and private research throughout the world is a major factor explaining their level of agricultural development. Moving from traditional to modern agriculture does not mean a one-time shift from one set of traditional cultivars to another set of improved cultivars, but rather a reduction in the time it takes farmers to gain access to the latest generation of new technology. In developed agricultural communities, new varieties steadily push out old varieties; seed industry specialists estimate the normal market life for a variety at under 10 years. In contrast, farmers in developing countries typically have access to no more than a handful of improved varieties for major and minor crops, and many of those varieties are relatively old.

For developing farming communities to grow, improving the channels for introduction of new varieties is crucial. Notably, varieties developed with some of the latest technology may be most immediately useful in developing countries;

... a great deal of biotechnology is immediately applicable to Third World agriculture... Traits such as disease

resistance, insect resistance, stress tolerance ... can be of immense importance in meeting the food needs of the Third World (Sehgal 1992, p 24).

#### *Competing explanations for low adoption of improved varieties*

The share of cultivated area planted with improved varieties is low in many developing countries. Standard explanations for limited adoption of improved varieties include:

- Due to agroecological peculiarities, varieties imported from other countries perform no better than traditional varieties. According to this argument, specific agro-ecological zones — and other factors such as tastes — require made-to-order breeding for multiple agro-ecological zones within each country.
- Seeds of varieties available for import are too expensive or come with input packages that are too expensive for poor farmers. These explanations are misleading.

Agroecological differences obviously affect variety performance, but emphasizing the importance of different varieties for different agro-ecological zones is at least as strong an argument for variety import as for in-country breeding. Considering the dozens of major and minor crops grown in multiple agro-ecological zones in an average developing country with its limited agricultural research capacity, heavy reliance on direct adoption of foreign varieties is the only strategy that promises to deliver varieties fast enough to give farmers effective access to the flow of modern agricultural technology. As for seed costs, rate of return to investment is the crucial

issue. While low labor costs may encourage poor farmers in developing countries to pass over tractors, herbicides, and sprinkler systems in favor of labor intensive alternatives, improved seeds are not so easily replaced by more labor. Investments in improved seeds are divisible, so that even very expensive seeds purchased in small quantities may be good investments within reach of poor farmers.

The story that technology transfer has been tried and failed is not generally true. More often than not, farmers have not had a chance to decide whether varieties are agro-ecologically suitable, and whether imported or hybrid seeds are too expensive. One expert on seeds in Africa observes:

A range of improved varieties exist which today are not multiplied and distributed to peasant societies, despite an obvious need for them (Friis-Hansen 1992, p 7).

Most farmers have never had a chance to see more than a handful of the improved varieties available in world markets. This handful has been selected by public sector scientists, who may not appreciate farmer priorities, so that the varieties that scientists offer to farmers, selected from thousands of varieties and after years of in-country breeding and testing, may not be the ones that farmers would have chosen "off the shelf" if given the chance. Lack of farmer adoption of improved varieties may say more about public sector scientists blocking farmer choice than the adaptability of varieties available in world markets.

## Seed trade controls: variety restrictions

### *Negative or positive variety lists*

In many World Bank client countries, government controls on varieties of seeds allowed for trade severely constrain private sector ability to introduce new varieties, whether through imports or in-country breeding and seed production. The following paragraphs describe several patterns for control.

*No prior government approval.* Some governments allow private traders to sell seeds of new varieties without any government agency testing and approving the variety. This approach allows traders and farmers to decide whether new varieties have any value. Chile, Thailand, the United States, Zimbabwe and some other countries follow this practice. Some governments allow private traders to introduce new varieties without performance tests for some crops but not for others. Through seed trade reforms in 1990, Bangladesh removed comprehensive controls on varieties allowed for import and sale and now allows private traders to make their own decisions to import and to sell seeds of new varieties for all but five major crops — rice, wheat, potatoes, jute, and sugar cane.

*No sale without prior government approval.* In this pattern, the government does not allow private traders to sell seeds of a new variety until some government agency has tested the variety and declared that it has some economic value for farmers. Two sub-patterns can be identified with this practice.

- *Single-country-variety lists.* Many governments maintain their own lists of varieties allowed for import or trade. This pattern, which is very common in developing countries, can make it so difficult for private companies to introduce new varieties that they do not even try. Some countries with single-country variety lists have detailed seed legislation setting the framework within which government agencies test varieties and limit seed import and trade — for example, Indonesia, Egypt, Kenya, Malawi, Sri Lanka, Uganda, and Zaire. Other governments accomplish the same thing through executive decrees, ministerial orders, and other bureaucratic decisions setting up committees, establishing variety lists, and restricting seed imports — for example, Burkina Faso, Burundi, Cameroon, Madagascar, and Niger. In non-market countries, for example, North Korea, governments monopolize commercial seed trade so that introduction of new varieties — from local public sector research or seed import — depends on administrative decisions within government agencies.
- *Multi-country variety lists.* Governments of many developed countries cooperate to maintain joint lists of approved varieties. For example, the European Union maintains a *Common Catalogue of Varieties of Agricultural Plant Species* (ie, field crops) and another *Common Catalogue of Varieties of Vegetable Species*. Traders intending to sell a new variety in EU countries submit seeds for testing to the government of at least one EU country. Normally, one to three years after any one

EU government has approved a new variety, it enters the common catalogue of field or vegetables crops, which means that seeds of the variety can be imported and sold in all EU countries.

Positive lists of allowed varieties — for example, the EU *Common Catalogues* — are inherently more restrictive than negative lists. The United States, for example, lists weeds, seeds of which are not allowed. But, multi-country positive lists, such as the EU lists, are in general much less restrictive than the single-country positive lists found in many developing countries. The EU *Common Catalogues*, for example, include thousands of varieties and have multiple points of entry. In general, any variety that sells well in the U.S. is able to gain entry into EU *Common Catalogues*, though the approval process delays marketing in EU countries for several years after a variety enters U.S. markets.

Many single-country variety lists are short, severely limiting farmer choice. In 1985, Egypt (with government approval of varieties required by law) listed only three improved varieties of maize, the grain crop covering the largest area. Improved varieties were planted in only 20 percent of the total maize area. (Food and Agriculture Organization [FAO] 1987, p 48, 50). Although Senegal in 1985 had no seed law requiring the government to approve new varieties, FAO in 1987 reported that six major crops "are subject to seed control" and listed only 19 approved varieties for these six crops (Food and Agriculture Organization 1987, p 110-111).

In other cases, single-country variety lists may be longer, at least for some crops. For example, Morocco in 1984 listed 62 varieties

wheat, including some old ones (Food and Agriculture Organization 1987, p 97).

*The case against regulating varieties:  
Foregone farm benefits*

These restrictions could be depriving farmers of seeds that would boost output and farm income. Several recent studies suggest that foregone benefits can be very large.

*Canadian wheat.* The Canadian government regulates varieties of wheat that farmers can grow and sell. In 1974, scientists tested HY320, a new variety of wheat with some different properties (similar to some of the wheat grown in the U.S.). Though HY320 produced yields 15 to 32 percent higher than competing varieties, the Canadian government blocked farmers from planting the variety for more than a decade. A study in 1987 estimated that had farmers been allowed to switch to the new variety, annual net farm income for wheat-growing farmers could have increased an average of 15 to 25 percent, equivalent to Cnd\$200-400 million across Canada (Ulrich, Furtan and Schmitz 1987, p 175).

*Californian cotton.* From 1929 to 1979, the State of California through the California One Variety Cotton Law restricted cotton growers in six counties to a particular type of cotton — acala cotton — and to varieties produced by one breeder, a local USDA experiment station. In 1979, after some farmers complained about the station's monopoly on allowed varieties to the U.S. Department of Justice, the California legislature amended the law to permit private breeders to introduce new varieties, with some

continuing government controls. By the end of the 1980s, new private varieties covered almost 50 percent of cotton area and had boosted aggregate cotton production in the six counties by 10 to 15 percent (Constantine, Alston, and Smith 1993, p 16). A recent study estimated that annual producer and consumer surplus increased US\$170-180 million (equivalent to about 12 percent of total cotton sales from the six counties) with introduction of new varieties during the 1980s (Constantine, Alston, and Smith, p 19).

These two studies demonstrate for developed countries, where farmers and private seed companies have some power to protect their interests, that:

Agricultural legislation and the resultant regulation that usually ensues can often change, redirect, or even stop the adoption of yield-increasing technologies that have the potential to generate substantial economic rents (Ulrich, Furtan, and Schmitz, p 160).

While similar estimates of foregone income associated with variety limits are not available for developing countries, a recent cross-country study of maize yields suggests that restrictions on maize seed imports slow technology transfer. Pray and Echeverria's statistical regression of maize yields from 1961 to 1986 in 50 countries, most of which are developing countries, against maize seed imports, public research, private research, education, fertilizer use, and other variables found that:

seed imports and multinational research are the only technology transfer variables that are statistically significant... Public-sector

research was not significant..." (Pray and Echeverria 1988, p 372-373).

The study concluded that:

seed imports and private research can be important sources of improved technology and also that the two are closely related.

...countries which restrict the import of corn seed are losing out on an important source of growth in corn productivity (Pray and Echeverria 1988, p 372).

While Pray and Echeverria show foregone yield increases associated with trade limits, their study does not estimate foregone production or farm income. No other studies have been found that estimate losses in terms of foregone yield increases, production, or farm income associated with limits on private sector introduction of new varieties in developing countries.

#### *Critique of common arguments for regulating varieties*

Those who argue that governments should test and approve varieties as a condition for sale propose several scenarios for risk without regulation. One author, for example, hypothesizes that "a disastrous effect on food supplies...could result from the extensive use of a poor-yielding variety," and asserts that "the farmer should be given some protection against exploitation by those who might try to market an unsatisfactory variety simply to recoup breeding costs" (Kelly 1989, p 43). The EU asks member governments to consider "value for cultivation" in deciding whether to allow a seed company to introduce a new variety:

To be accepted for the catalogue a variety must show a clear improvement over varieties already available either in the characteristics which enhance its value for cultivation or for the use that can be made of the crops grown from it or of the products harvested from them (Kelly 1989, p 105).

In short, the standard argument for governments to regulate varieties of seeds allowed for sale is to protect farmers from the consequences of their own decisions.

Fears that a product might be widely adopted before its poor performance are appreciated and that traders might try to dump bad products are not peculiar to seeds. Risk of widespread adoption before poor performance can be recognized may be less of an issue for new varieties, for which farmers can determine performance from neighboring fields or in small plots with little risk, than for many other products. Consider some other products: consumers are not experts in metal alloys crucial to the durability of internal combustion engines or electric appliances, yet governments allow traders to import makes and models without prior approval and without warranties. For these and other products, standard practice is to allow new goods to enter the market, leaving buyers to evaluate options and to discipline unscrupulous traders by withdrawing patronage; governments intervene to ensure truth in labelling, to limit externalities and protect public health, but not to protect buyers from the economic consequences of their own potential mistakes in judgement.

*Externalities that might justify variety restrictions*

Microeconomic theory asks and accepts that governments intervene in markets when negative externalities threaten. Although there is no general consensus among seed experts about externalities that might justify limits on varieties of seeds allowed for sale, externalities considered in the literature include the following:

*Spread of weed seeds.* Weed seeds may be mixed with crop seeds for sale. A farmer buying and planting such seeds may damage neighboring plots, creating an externality. Also, introduced plants could become weeds; water hyacinth, reportedly introduced into South Asia as an ornamental, is an example.

*Risk of sudden fall in production for a major crop.* A variety being introduced to a country could have serious but not readily apparent susceptibility to pests or disease. This could be a problem if the variety is for a major crop and is so attractive that farmers might commit a large area to the crop, jeopardizing regional food supplies and economic stability. The Irish potato famine demonstrates this risk. But government restrictions on private sector introduction of new varieties arguably leave farmers with fewer varieties, enhancing pest and disease risks associated with genetic uniformity. Furthermore, governments could initially deal with the risk associated with a susceptible variety by monitoring its adoption and telling farmers about its susceptibility; action to limit access to the variety or to limit area planted to the variety could be taken after some time.

*Spread of disease to neighboring fields.* A variety for a major crop may be so susceptible to a disease and so consistently infected that it spreads the disease to neighboring fields. IR50 rice, for example, acts as a nursery for rice blast.

*Damage to wild races or ecology in Vavilovian centers.* New varieties for cultivated crops that are introduced into regions with wild races of the same crops could transfer genes into wild races. This could affect genetic variability of wild races, and could also affect other organisms, such as plant-eating insects.

As illustrated, there may be some situations in which externalities are present as farmers choose varieties, and in some cases blocking access to specific varieties may be an appropriate response. When externalities are an issue, governments may arguably deal with concerns through short negative lists of varieties or genes not allowed, focusing attention on weeds, major crops, and crops in their Vavilovian centers. Concern over externalities should not lead to positive variety lists for all crops, as it so often does in developing countries.

*Impact of variety controls on private sector seed trade*

For seed company personnel weighing whether to invest in trade or research to introduce a new variety into a developing country, government approval of each variety may mean standard delays counted in years to test each new variety with no assurance that it will be approved; steep fees for testing each variety, as well as limits on numbers of

varieties that a company can submit for testing in one year; and fears that testing will not be fair or objective, bribes will be demanded, and varieties pirated.

With few exceptions, in developing countries with the largest private seed sectors (measured in terms of share of cropped area for which private companies supply local or imported seed), governments allow private companies to introduce new varieties without government tests and approvals. For example, private seed companies in Zimbabwe supply seed for about 40 percent of planted area. The *FAO Seed Review 1984-85* (1987, p 151) reports for Zimbabwe that: "Varieties developed by private companies can be sold without prior government approval unless the seed is to be sold as certified seed."

Private seed companies in Thailand, which does not limit varieties allowed for trade, provide seed for about 25 percent of planted area. In India, private seed companies supply seed for about 7 percent of planted area; although India restricts sale of imported seed according to varieties, majority locally owned companies are able to sell locally produced seed of varieties that the government has not tested and approved. In Chile, private seed companies supply seed for more than 50 percent of planted area; private companies are allowed to introduce locally bred varieties and also varieties registered in foreign countries without prior government variety testing and approval.

When variety lists are not binding, companies of all sizes can be expected to take part in importing, testing, and producing seed for new varieties. Small-to-medium size local companies with low overhead may have an

advantage in importing and marketing seed, field-testing and test-marketing new varieties, and producing seed for self and open-pollinated varieties. Large national and international seed companies may have the advantage in all kinds of breeding and also in producing hybrid seed for major crops, including maize, sorghum, and sunflower

Some recent seed company moves in and out of developing countries suggest that governments that regulate varieties discourage private companies as competitors but may encourage private companies as monopolists. As Nigeria adopted World Bank-endorsed seed legislation mandating government variety testing in the early 1990s, two out of three international seed companies active in Nigeria left the country. The Indonesian government regulates varieties; in 1990, Cargill left Indonesia, leaving behind two other multi-nationals. But multi-nationals also have bought into several African countries where governments regulate varieties allowed for trade. In 1990, Pioneer entered into a joint venture with the parastatal Ethiopian Seed Corporation, an arrangement that reportedly has run into some difficulties. In Malawi, Cargill has become majority share-holder in the National Seed Corporation, a former parastatal. When a private company buys part-ownership in a parastatal, governments may regulate varieties to protect public-private joint ventures as monopolies, though other outcomes are possible.

When governments remove variety restrictions and other barriers to seed import, some increase in imported seed can be expected. For most seeds, however, transport costs (including cost to satisfy phytosanitary

regulations) are significant relative to profits. These cost considerations push companies to import parent stock and to produce seed in-country. In Thailand and Chile, two countries with multinational seed companies and liberal seed import policies, imported seed serves an estimated 1 to 2 percent of planted area only. The share of seed provided through imports would tend to be higher the smaller the country.

### Other features of seed trade controls

#### *Tariffs*

With some exceptions, tariffs are not a major barrier or an issue for seed imports for developing countries (McMullen 1987, p 229-231). Non-tariff barriers constitute the biggest obstacle to imports.

#### *Non-tariff barriers: commercial protection*

Some countries ban seed imports or exports for selected crops based on various commercial concerns. India, for example, has in the past banned imports of seed for rice, wheat, and other crops, presumably to preserve self-sufficiency in seed supply, and has banned exports of hybrid cotton seeds to protect local cotton producers. Kenya restricts seed imports for "crops for which the country has a production capacity for its national needs" (Riugu 1988, p 91), and allows seed exports "provided domestic self-sufficiency is assured" (Food and Agriculture Organization 1987, p 78). Thailand has limited exports of mangosteen cuttings to protect local fruit growers. Many other examples of

commercially-motivated export or import restrictions can be found.

#### *Non-tariff barriers: phytosanitary controls*

As obstacles to seed trade, the two most important non-tariff barriers are variety lists (already discussed) and plant quarantine regulations. Pests and diseases coming in on seeds may spread far beyond fields planted with imported seeds, causing large negative externalities. The threat of such externalities justifies phytosanitary controls.

Designing phytosanitary restrictions involves making trade-offs between loss to the economy when seeds are not given entry, and loss when pests and diseases are introduced. These trade-offs create opportunities for honest disagreement, with some experts more alert to potential gains from seed imports arguing that restrictions are too tight, and those more aware of pest and disease threats arguing for current or even tighter import restrictions. Seed company representatives consider over-tight phytosanitary restrictions to be a major obstacle for seed import into developing countries.<sup>4</sup>

Phytosanitary restrictions take various forms, including:

- Bans on imports of all seeds for specific crops;
- Bans on imports of seeds for specific crops from specific countries on the grounds that certain pests or diseases are present in those countries;
- Requirements that imports of seeds of specific crops be treated in specified ways to kill particular pests and diseases; and

- Requirements that imports of seeds of specific crops be grown for testing or multiplied in quarantine through one or more generations to ensure that diseases or pests are not coming in with the seeds.

The scientific bases for phytosanitary regulations are sophisticated and complex. Design of regulations builds on an immense amount of detailed information about crops, countries of origin, pests, and diseases. Various international fora coordinate phytosanitary regulations among member governments. More than forty countries established the International Plant Protection Convention in 1951 in collaboration with the Food and Agriculture Organization; membership more than doubled through 1987. Regional organizations include, for example, the Asia and Pacific Plant Protection Commission and the European and Mediterranean Plant Protection Organization. Developing countries take assistance from international organizations in designing phytosanitary restrictions.

Private seed companies work with international government organizations and also work through private international organizations such as the Federation of International Seedsmen. To facilitate international seed trade, companies ask governments to set standard procedures for performing a pest risk analysis. During 1993, North American governments, through the North American Plant Protection Organization, agreed on standard procedures for pest risk analyses.

In many developing countries, governments have little ability to stop introduction of pests and diseases through uncontrolled cross-border

trade as well as through legal imports of non-seed plant products. Considering how open many countries are to plant pests and diseases through channels other than legal seed imports, phytosanitary restrictions obstructing seed import may warrant another look.

### *Variety Registration*

Most governments have an organization that registers varieties, which at the minimum means identifying, describing, and naming the variety. Identifying and describing a variety involves growing out seeds for several generations to see that plants are distinct and uniform and that characteristics are stable over several generations (DUS criteria). When a variety has been registered, seeds of the variety can be certified — or identified as true to the variety.

In many developed and developing countries with modern private seed industries, such as Argentina, Chile, United States, and Zimbabwe, registration is available but voluntary. With voluntary registration, company motives for registration include facilitating seed export — importing countries may demand certified seed, which requires variety registration — and preparing to register ownership, which may involve additional paperwork. With voluntary registration, companies can be expected not to register many varieties.

In some countries, registration is compulsory. Compulsory variety registration is common in World Bank client countries, though in practice traditional varieties are often ignored and only improved varieties are registered. Governments with compulsory

variety registration often require in-country testing for several years, charge companies thousands of dollars for each variety entered in the testing process, and test for performance as well as DUS criteria. Compulsory registration is often the administrative instrument through which governments implement restrictions on varieties of seed allowed for import and trade.

Compulsory registration may be less onerous when the registering agency accepts all varieties (seeds meeting DUS criteria) without attention to variety performance, accepts information from other governments that have registered the variety, and provides registration as a free service. Chile and Turkey, for example, allow seed imports for varieties registered in the exporting country. EU governments accepting varieties listed in EU Common Catalogues in effect accept registration in other countries.

Compulsory registration, which requires handing over seed samples to government agencies, may discourage private companies from importing valuable germplasm (breeding lines or parent lines for hybrids). Companies may fear that governments will divert seeds to public sector breeding programs or to competing companies. By some accounts, government demands to test seed samples have in recent years been an obstacle for multinationals interested in expanding seed research and production in India and China.

Compulsory registration is not a benign policy. Aside from allowing government agencies to harass private traders, compulsory registration threatens bio-diversity.<sup>5</sup> While much seed in developing countries is farmer-retained seed or is traded farm-to-farm and avoids government controls, in EU countries

seed for most crops passes through market channels where it is subject to government regulations. Compulsory variety registration forces breeders to remove genetic variability to meet uniformity criteria, allowing a variety to be registered, which in turn allows seed to be sold. Seed of land races not meeting DUS criteria and not presented for registration by any company is not allowed for sale. In the EU, compulsory variety registration tends to drive out genetic variability and land races. This process is not very far along in developing countries with compulsory registration.

#### *Seed certification*

Seed certification is an assertion by some organization, which could be private but is often public, that a particular lot of seeds is of the stated variety and meets other quality standards. Developed countries follow different systems; those with voluntary certification — including the United States — deliver quality seed to farmers at least as dependably as those with compulsory certification.

Insofar as the development of a modern private seed industry in developing countries is concerned, the major issue with respect to certification is whether it is voluntary or compulsory. Seed certification is voluntary in many of the developing countries where private seed companies are most active, such as Zimbabwe, Chile, and India. For seed sold domestically, large companies characteristically opt to sell seed without certification, relying on customer confidence in brand name; voluntary certification may be of

more interest for small and new firms without reputations for quality linked to well-known brand names.

Compulsory certification forces seed producers to deal with another government office, which could be a nuisance or an insurmountable obstruction. In place of compulsory certification, governments could promote seed quality control through "truth-in-labelling, with the seed firm attaching quality control labels" (Grobman 1992, p 140-141).

### *Intellectual property rights*

Whether and how to protect intellectual property rights in varieties is a matter for current debate even for developed countries. In the U.S. and other countries with the most advanced seed science, opportunities for intellectual property rights in varieties, genes, and breeding processes expand with legal changes and technical progress. Modern legal and technical infrastructures are essential to enforce evolving intellectual property rights.

Many developing countries with relatively advanced private seed industries offer plant breeders' rights — Zimbabwe, Argentina, and Chile — covering some of the ownership issues dealt with in current legislation in developed countries.

Experts disagree on how much and how fast to press for plant breeders' rights in developing countries. A 1988 study of the Thai seed industry asserts, for example:

There is no plant variety protection in Thailand and, in its current stage of development, the private sector does not think that such industry protection is feasible. Indeed, it is difficult to imagine

such a complicated law suit being heard in our very busy Thai courts...

In practice, trade secrecy is used by private companies to protect their research. Most private companies in Thailand as well as other countries are investing in hybrid seed (Setboonsarng and others 1988, p 55).

The potential gain to countries that strengthen intellectual property rights is measured in terms of additional technology that seed companies will be encouraged to import or to develop in-country. Suri Sehgal and Jan Van Rompaey of Plant Genetic Systems, a Belgian biotech company, argue that at the present time, trade liberalization may be a more important stimulus for technology transfer than steps to strengthen plant breeders' rights:

[In most developing countries] the seed industry itself is in the early stage of development. Adoption of [intellectual property right] laws in such countries can stifle growth rather than accelerate development...

... Their seed business will be able to develop only if there is appropriate transfer and absorption of technology from the industrialized countries. Consequently, legislation should promote such transfer rather than promulgating sophisticated property rights which are ill-adapted to the technology level of these countries (Sehgal and Rompaey 1992, p 12-14).

With hybrids, seed legislation is largely unnecessary to protect intellectual property rights. Private seed companies are able to maintain ownership of hybrids through physical control of in-bred parent lines. In developing countries, large research-oriented

multinational seed companies focus much of their effort on hybrids.

With self or open-pollinated varieties, on the other hand, private seed companies lose profits when farmers and competing companies multiply and sell seed. But laws formally protecting ownership of self or open-pollinated varieties would be of little value in those developing countries where governments are unable to control seed sales by farmers and small-scale merchants. For developing countries with small seed markets, in-country seed research on self and open-pollinated varieties may be slow to develop in any case. Countries may be served by imported varieties, with relatively small local companies importing seeds, testing varieties, and multiplying seeds to serve local markets. Such research does not involve large investments and overheads provided compulsory variety registration, government variety testing, or other government restrictions are not in the way.

When establishing procedures to protect plant breeders' rights in new varieties, care is in order to prevent private companies from claiming ownership of common varieties and varieties developed by International Agriculture Research Centers. Such claims would constitute a restraint on trade.

#### *Public sector seed companies*

In many developing countries, one or more public sector agencies, including parastatals, produce foundation and commercial seed and sell to wholesale or retail levels. Government agencies in most countries provide seed for only a small share of planted area (seldom

more than 10 percent), and even that share is only possible with subsidies. Governments that restrict private seed trade and try to fill the gap with public sector seed supply inflict heavy costs on farmers in terms of foregone production increases:

It has been amply documented that the public systems have failed to produce sufficient high quality seed for the potential country or region demand, especially of the more difficult to produce seed categories: hybrids of maize, sorghum, sunflower, vegetable, and potato seeds. As to seeds with low propagation coefficients (ratio of harvested to seed quantity planted), such as the cereals, ... results have been less than satisfactory almost everywhere, both as to quantity of certified seed produced and as to its quality (Grobman 1993, p 139).

Most government agencies focus on self or open-pollinated varieties for major grain crops, competing with farmers who multiply seed for own use, whereas an emerging private seed industry focuses, characteristically, on hybrid seeds and other relatively high value products.

#### **Aspects of donor aid and advice**

##### *Supporting governments to regulate varieties*

Through advice and conditions attached to projects, the World Bank and the Food and Agriculture Organization have often accepted and even advocated government limits on varieties of seed allowed for import and trade. Less often these organizations have encouraged countries to leave variety choice to market mechanisms.

In several countries, the World Bank has over the years been associated with successful seed trade reforms. During the early 1980s, Turkey issued decrees allowing private firms to import and sell seeds of new varieties without prior government testing and approval.<sup>6</sup> With seed reforms in place, the World Bank prepared an Agricultural Sector Adjustment Loan for Turkey, endorsing reforms and offering money for private seed imports. Mexico is another country in which the World Bank has supported significant seed trade liberalization.

While the World Bank has at times promoted seed trade liberalization, it has often supported imposition or continuation of restrictions on varieties allowed for trade. In Bangladesh, another country with successful seed trade liberalization, the Ministry of Agriculture in 1990 ordered that seeds of all varieties for all but five crops be allowed for import and sale. Conditions attached to a World Bank loan in 1991 retreated and asked that the government allow private companies to import seeds for testing, implicitly accepting that government agencies continue to test varieties and to control whether private companies sell seeds of new varieties to farmers. Bangladesh appears to have succeeded with seed trade liberalization in spite of some confusing World Bank advice.

In conjunction with a 1992 Second Agricultural Extension Project for Sri Lanka, the World Bank encouraged the government to revise seed institutions and policies. Proposed reforms include establishment of a National Seed Board, which would take over responsibility to approve varieties for sale based on variety performance tests.

The World Bank supports Nigeria's 1990 National Seed and Quarantine Project, advising the government to draft and implement new seed legislation and to establish new government agencies to supervise seed trade. With new arrangements, governments test all new varieties, including those proposed by private companies; the National Variety Registration and Release Committee decides whether to release any variety, which for a private company is equivalent to deciding whether the company is allowed to sell seeds of the variety. Through the project, the World Bank encourages the government to allow the private sector to import seeds for breeding programs and for multiplication, but does not object to government controls on import of seed for commercial sale.

A recent World Bank paper on "Seed System Development: The Appropriate Roles of the Private and Public Sectors," raises the spectre of "moral hazard" when private companies import seed to introduce new varieties. The paper proposes that governments be responsible for local adaptation tests (Jaffe and Srivastava 1992, p 25). Another recent World Bank volume cautions "New varieties must be widely tested on farms to make sure that they perform at least as well as traditional varieties" without addressing the crucial question of whether or not private seed traders may be left to test new varieties on their own without public sector oversight (World Bank 1989, p 95).

In 1984, a Food and Agriculture Organization expert committee on seeds recommended that governments

... enact legislation prohibiting the sale or offer for sale of seed below prescribed

quality standards. These standards may cover all or only some of the quality factors of seeds (Food and Agriculture Organization 1984, p 2).

The aspects of seed quality listed by the committee include genetic quality — variety performance. The committee further

... agreed that in setting up such a system it would be necessary to establish means of listing and describing crop varieties which might be included... (FAO 1984, p 2).

An annex to the report suggests that countries might begin by regulating analytic quality and germination only, which would leave choice of variety to private traders and farmers (FAO 1984, p 30-31).

While donors urge governments to regulate seed quality, an alternate approach to improving seed supply at the farm level is to promote quality through competition. Suri Sehgal, a seed company executive, asks donors to focus on seed trade liberalization as crucial to private sector development:

Development agencies can encourage national governments to create the conditions for private seed sector development. Liberalization of seed and germplasm imports and exports is crucial in this regard. (Sehgal 1992, p 25)

In a strategy of quality through competition, "legislation should focus on how to attract serious companies, rather than becoming a watch-dog for a few bad ones." Markets discipline private companies that sell unreliable seeds: "to stay in business in the long term, high quality products will have to be provided to the customers" (Sehgal and Sindhu 1992, p 77).

### *Donor association with government seed agencies*

For many years, donors promoted seed production through government agencies, including parastatals. More recently, donor attention to government seed producing and trading agencies has focused on reforms, such as shifting commercial seed production or retail seed trade to the private sector. Nevertheless, donors including the World Bank continue to pay for seed production through government organizations. For example, a portion of World Bank aid for the National Seeds and Quarantine Project in Nigeria supports production of foundation seed in federal and state agencies.

In countries with relatively large government seed agencies, reform efforts that focus on commercializing or privatizing seed agencies, rather than on liberalizing seed trade, carry major risks. Project aid might be accepted to continue government activities, while reforms such as cuts in seed subsidies are not sustained. And government agencies could be privatized to monopolies, bringing little change in seed market behavior. Furthermore, pay-offs to farmers from reforming government seed agencies may be insignificant without concurrent trade reform, since farmers may be left with higher prices for the same poor choice of varieties.

When a competitive private seed industry is allowed free access to seeds and germplasm available on the world market, government agencies offering relatively unattractive varieties and poor quality seed can be expected to lose sales, even with subsidies. Popular support for subsidies to government seed

agencies can be expected to erode as private companies demonstrate their ability to supply better seed at no cost to the government. Privatization through withering away of government seed production and trade can be a relatively painless by-product of seed trade liberalization.

## Recommendations

The primary objectives of the following recommendations are to improve farmer access to the flow of new seed technology from laboratories and research plots throughout the world and to accelerate agricultural growth. Secondary objectives include promoting private research in developing countries, promoting private seed trade, and saving government money by cutting subsidies to government seed agencies.

*Recommendation for governments: Open doors for the private sector to introduce new varieties by removing restrictions on seed trade that do not address externalities or plant breeders' rights, including variety performance tests, compulsory variety registration, compulsory seed certification, and unreasonable phytosanitary restrictions.*

In most if not all cases, governments could implement this recommendation without changing seed laws. In countries with seed legislation mandating government agencies to evaluate and release varieties, agencies are often empowered to set their own policies. In Bangladesh, for example, the Ministry of Agriculture implemented seed liberalization in 1990 by declaring that seeds of all varieties for

all but five crops would be allowed for import and trade.

Opposition to seed trade liberalization can be expected from public sector agricultural research agencies. In most developing countries, government research agencies have had a monopoly for many years on importing, testing, and breeding new varieties. As long as government committees regulate introduction of new varieties, government scientists have a channel to block private company efforts to introduce new varieties through seed imports and in-country breeding. These scientists may feel that their funding and career goals through the government research agencies are threatened by successful technology transfer through private seed trade. To reduce opposition from government scientists, it may be useful to clarify that reforms promoting private technology transfer can be consistent with maintaining or even increasing allocations for government agriculture research, which can focus on issues not served through the private sector.

The argument is sometimes made with respect to seeds that foreign companies are not willing to introduce their latest technology into developing countries that do not have laws establishing intellectual property rights. This argument bears some examination.

Seed companies in developed countries have no mechanisms to stop someone from a developing country from buying and importing their goods. Barriers to introduction of new technology are not created by companies but rather by governments of importing countries. Countries that ease import barriers gain access to inputs and technology with or without intellectual property rights.

Advocates for intellectual property rights and those who fear impact of intellectual property rights on developing country access to technology may be able to agree on trade liberalization as an interim win-win solution, allowing countries to import more technology, increasing company sales, and increasing the technological sophistication and wealth of developing countries.

Over time, as private companies offer more varieties for more crops, the private seed industry expands. Depending on the size of the country, seed companies will sooner or later begin in-country research and breeding programs. As in-country private seed research grows, legislation to protect plant breeders' rights becomes more important. At the same time, the technological and legal framework for enforcing legislation matures.

*Recommendation for International Agriculture Research Centers: Insist that member governments place no restrictions on private import of lines or on sale of seed from multiplying lines.*

As Neil McMullen notes in *Seeds and World Agricultural Progress* (p 179),

government agencies in developing countries have had "preferential access to new varieties developed by the International Agricultural Research Centers." In most developing countries, private import of lines from any of the IARCs or selling seeds from such lines is not allowed without prior government testing, which in practice has meant that only government research system scientists get access to IARC lines, except for the few lines that are eventually allowed through for seed multiplication. In donor circles this generally goes unremarked.

Taxpayers and foundations in developed countries fund IARCs to aid the peoples of the developing countries. With current arrangements, these centers' ability to deliver technology to farmers is limited by policies of many member governments, which allow government research systems to monopolize testing and introduction of IARC technology. This reduces returns to IARC research, which may also undermine their ability to raise funds. More to the point, it blocks potential welfare gains for farmers and consumers in developing countries, whom IARCs have been established to help.





# 3

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## *Restraints on Fertilizer Trade*

**N**on-tariff barriers on fertilizers limit farmer access to micro as well as macronutrients. The contribution of macronutrients (nitrogen, phosphorus, and potassium) to higher yields is well-known. But policymakers often underestimate the role of micronutrients: farmers' lack of access to fertilizer products with sulphur, boron, manganese, zinc, and other micronutrients may lead to declines in soil fertility, low marginal returns to investments in macronutrients, and low ceilings on yields.

Trade liberalization for fertilizers can be accomplished by removing all fertilizers from import control lists, allowing private importers to decide volumes and types. In developing countries, externalities with fertilizers are rare. Externalities may be expected to emerge in specific locations — for example, fertilizer run-off into a lake — where they can be

addressed through local use guidelines rather than controls on trade. Accordingly, for fertilizers there is no need to preserve any trade restrictions to deal with externalities, as is the case for seeds.

Among all agricultural inputs, fertilizers account for the largest share of import trade by value in most World Bank client countries. Even so, the value of fertilizer imports as a share of all merchandise imports is low: in 1990, for all Bank clients with a population of more than five million, fertilizer imports accounted for less than 1 percent of merchandise imports in more than half of the countries and more than 4 percent of merchandise imports in only four countries — Vietnam, 14 percent; China, 5 percent; India, 4.6 percent, and Bulgaria, 4.2 percent. Considering these overall figures, countries can eliminate tariff and non-tariff barriers blocking private fertilizer imports without affecting macroeconomic variables, such as volume of merchandise imports or exchange rates.

### **Changes in fertilizer use with development**

A country's average level of fertilizer use per hectare is one of the clearest indicators of modern agricultural practices. Fertilizer use in developed countries defines international best practice. In some of the developed countries with heavy use of fertilizer, application rates have been growing very slowly or even declining over the last several decades. Developing countries, however, are still driving toward rates of application that are consistent with current best practice.

The rate of fertilizer application consistent with best practice varies according to many factors: agricultural population per hectare of cropland, climate, particularly rainfall, and percent of cropland irrigated, to name a few. In Asian irrigated agriculture and in Western Europe, rates of application near 400 kgs per hectare appear to be consistent with best practice. In Central Europe and North and South America, with typically more land per farmer, often with low rainfall and without irrigation, rates of application just over 100 kgs per hectare appear consistent with best practice. In Africa and the Middle East, rates of fertilizer application consistent with best practice would presumably fall somewhere in between these two levels.

Farmers in developing countries who gain access to fertilizers and other inputs that carry modern technology can be expected to increase fertilizer use over time. Instant increases to world best practice rates of application are not realistic in most situations because rates of application depend on farmers' ability to adopt a wide range of modern agricultural inputs and practices. This time lag would not disappear even if all import barriers were removed.

In any specific region of a developing country, farmers rich and poor will tend to follow the same standard input package for each crop, applying, for example,  $x$  kgs of nitrogen per hectare. Since rich and poor farmers tend to apply roughly the same number of kgs per hectare, lack of money does not explain why farmers do not apply  $2x$  or  $3x$  kgs. Farmers presumably act on experience that in their specific situation, marginal returns for incremental applications up to  $x$  kgs of nitrogen are good enough, and that if they

apply more than x kgs of nitrogen per hectare, they run into problems — such as lack of response due to micronutrient deficiencies that the farmer does not yet understand or have an ability to control. As farmers in an area learn more about micronutrients and other inputs and techniques to manage soil fertility and to achieve higher yields, they can be expected to shift to higher levels of fertilizer use. This process continues as farmers move toward current international best practice.

From the early 1960s to the late 1980s, aggregate fertilizer use in Bangladesh, Brazil, China, India, and Indonesia increased at compound annual rates of 11.0 to 13.3 percent.<sup>7</sup> These five countries achieved such large increases over time despite sometimes binding government controls on volumes and types of fertilizer allowed for trade. At times, government mismanagement of fertilizer supplies forced declines in total fertilizer use over several years — for example, fertilizer use in China fell by more than a quarter from 1966 to 1968 and did not regain 1966 levels until 1970.

During the period, nitrogen fertilizer prices in Brazil and India have tended to be above world market levels, while prices in Bangladesh and Indonesia were above about as often as they were below world market levels (International Rice Research Institute 1991, p 259-62). The record of these five countries suggests that for many developing countries, realistically achievable annual increases in fertilizer use are at least the 11 to 13 percent compound annual increases that these five countries achieved over time with less than ideal policies.

## Patterns for fertilizer trade

Developing countries have followed several standard patterns for fertilizer trade, including: government monopoly, controlled private trade, and free private trade. The defining feature for these patterns is the nature and degree of government control over private fertilizer imports.

### *Government monopoly*

Governments of many developing countries assign fertilizer production and trade to government agencies, including parastatals, and prohibit private fertilizer import. While government production and trade may waste money, prohibition of private imports arguably causes the most damage.

Barring private imports of fertilizer magnifies any mistakes by bureaucrats who control fertilizer availability and use. For example, misjudgment or tight budgets might lead a government to produce or import less fertilizer than what the market would bear. Also, if a government, perhaps taking advice from public sector scientists, decides not to offer certain types of fertilizers, then farmers do not have choices. These decisions can lead to serious problems if farmers cannot buy inputs to repair micronutrient deficiencies. For example, Bangladesh Agricultural Development Corporation (BADC) decided some years ago to deliver nitrogen exclusively in the form of urea, withdrawing farmer access to ammonium sulfate, a decision that contributed to serious sulphur deficiencies; public sector scientists and the BADC staff did

not adequately address sulfur deficiencies for many years.

When governments monopolize fertilizer trade, competing demands for local and foreign currencies often restrain imports.<sup>8</sup> As noted in the World Bank's long-term perspective study on sub-Saharan Africa (1989, p 95): "Fertilizer arrived only when governments had both the necessary foreign exchange and the inclination to spend it accordingly."

In addition, when governments subsidize fertilizers, the budget constraint becomes binding more quickly; as McIntire (1986, p 55) notes:

If the total subsidy is fixed, then a larger subsidy per unit implies a smaller total quantity of imported fertilizer because of the government's financial constraint.

In recent years, many countries have abandoned government import monopolies. The BADC's monopoly on fertilizer imports was broken in 1990 and 1991 as private dealers gained the right to import any amount of any fertilizer. The Tanzanian Fertilizer Company lost its monopoly on fertilizer import in 1992. Empresa Nacional de Comercializacion de Insumos in Peru lost its monopoly on fertilizer imports with reforms under Fujimori in the early 1990s. Recently China's central government ended its fertilizer import monopoly, allowing provincial governments to use their own foreign exchange to import fertilizer.

Some countries with government monopolies on fertilizer imports have in the past achieved rapid growth in fertilizer use — for example, Bangladesh, China, and Indonesia — though year-to-year fluctuations and lack of

access to micronutrients for efficient fertility management are evident. In short, the pattern has worked to some extent in some countries. But government import monopolies for fertilizer can be found in many poor countries with low rates of increase in fertilizer use over decades.

### *Controlled private trade*

In many countries, a government agency controls fertilizer imports, approving each shipment, while some or all of the actual importing and trade may be left to one or more private companies. This pattern retains the major weaknesses of the public sector monopoly pattern previously described: government may not allow import of as much fertilizer as farmers would buy and may not allow import of the types of fertilizers that farmers could use to maintain soil fertility. On top of these weaknesses, the arrangement allows private traders to profit from restraints on trade.

Many developing countries have followed this pattern. In Kenya, "Because the Government policy is to encourage the development of an active private sector, all fertilizer importation, other than that with donor aid, is undertaken by private firms and cooperative unions." However, "limitations are set on types and quantities to be imported by each private firm. Maximum retail selling prices are also set by the Government" (Amukoa 1990, p 49-50). In the Philippines during the early 1980s, the government's Fertilizer and Pesticide Authority determined types and quantities of fertilizer to be imported, managed tenders for private firms,

and limited imports to five firms only. With reforms in the mid-1980s, the Fertilizer and Pesticide Authority lost control of imports so that the five favored private firms lost their import oligopoly. World Bank sources report that as many as twenty-four private firms imported fertilizer by 1987, and the difference between farm level and world fertilizer prices fell significantly.

Countries with government-controlled private fertilizer monopolies or oligopolies often show poor growth in fertilizer imports and use, unstable supply, and transparent arrangements to extract short-term profits from fertilizer trade.

#### *Free private trade*

Countries following this pattern allow anyone to import any amount of any fertilizer. Across developing countries, this pattern has been rare, but it is gaining adherents. Bangladesh in 1991 adopted this pattern, taking all fertilizers off the import control list. Turkey liberalized fertilizer imports in 1986. With reforms, World Bank sources report increased competition, improved farmer access to fertilizers, and introduction of new products. South Korea, Brazil, and some other countries in East and Southeast Asia and Latin America currently follow this pattern. Free private fertilizer trade is less common in Africa and South Asia.

Liberalizing fertilizer imports entails assuring dealers equal and unrestricted access to foreign exchange at reasonable rates as well as withdrawing specific controls on fertilizer imports. Governments that maintain multiple exchange rates — for example, an official rate

and a market rate — may undermine competitive private trade by offering some traders access to a more favorable rate. Since fertilizers, compared to other agricultural inputs, are relatively standard bulk products with low profit margins, even very small differences in exchange rates can have a serious impact on profit margins.

#### *Mixed patterns*

Countries may display mixtures of the three patterns. Indonesia, for example, maintains a government trading monopoly for most major fertilizers while allowing the private sector to import other fertilizers. In India, the government "canalizes" trade in most major fertilizers, giving an import monopoly to the parastatal Minerals and Metals Trading Corporation, setting wholesale prices, and enforcing a cost-plus pricing system for fertilizer plants. For rock phosphate, sulphur, di-ammonium phosphate, and some other fertilizers, India allows uncontrolled import and trade<sup>9</sup> (Pursell and Gulati 1993, p 16).

Domestic public or private production of fertilizers appears to favor government interference in trade. This is not a decisive consideration, however. In Bangladesh, for example, private traders gained permission to import urea, a major parastatal product, one year after they gained permission to import triple super phosphate, a minor product, and muriate of potash, which is not produced domestically. In the 1970s and 1980s, Brazil levied high duties on fertilizer imports to favor domestic producers; reforms in the 1980s lowered duties and farm-level prices. In Chile during the 1960s and into the 1970s,

protection for the domestic nitrogen fertilizer industry raised prices to farmers, while for phosphate fertilizers, "the absence of a large domestic industry caused price intervention to provide low or even negative protection"; reforms in the 1970s lowered duties on nitrogen and eliminated subsidies (Hurtado, Valdes, and Muchnik 1990, p 66).

### Aspects of donor aid and advice

Over the last decade, donor aid and advice has been shifting away from support for government fertilizer monopolies to favor competition and private trade, including private imports. This reorientation is clear, for example, in the World Bank's 1989 long-term perspective study for sub-Saharan Africa:

Chemical fertilizers will be in demand...

The key is to ensure that reliable supplies are readily available at full cost... To reduce supply bottlenecks, private traders and enterprises should be allowed to import, produce, and distribute it themselves... Finally, foreign exchange should be available to pay for fertilizer imports as demanded... (World Bank 1989, p 96).

Despite a fairly clear shift in donor rhetoric and overall intention to favor competitive private trade, donors have often cooperated with continued limits on private fertilizer imports. For example, a 1991 Food and Agriculture Organization document advises governments to estimate fertilizer requirements as an input into decisions to release foreign exchange for fertilizer imports:

... it is extremely important that the [fertilizer] consumption requirements ...

should be estimated realistically, to avoid unnecessary imports.

Forecasts of fertilizer requirements are needed in discussions ... with the Central Bank for the release of foreign exchange (Food and Agriculture Organization 1991, p 21-22).

### *Accepting government controls on fertilizer types*

Recent fertilizer reform programs for Ghana and Bangladesh, endorsed and supported by the World Bank and other major donors, accepted continuing government restrictions on types of fertilizers allowed for import. Such limits obstruct technology transfer through the private sector.

Plans to privatize fertilizer trade in Ghana during 1988-91 focused on domestic trade, leaving the government's import monopoly in place until the fourth and final year of reform. Even then, the reform program proposed that the government continue to limit types of fertilizers allowed for import:

In the fourth year (1991), MOA will relinquish its importation role. ...it will make a public announcement that the private sector will be permitted to import *fertilizers that appear on an MOA-approved list [emphasis added]*, which will be published... With this, the transfer of fertilizer procurement and distribution to the private sector will have been completed (Dapaah and Otinkorang 1988, p 44).

In Bangladesh, the World Bank and Asian Development Bank (ADB) agreed on conditions for input trade reform, conditions that they attached to multiple loans in 1990-91.

Among the many conditions dealing with fertilizer trade, only one dealt with imports — a request that the government allow private unregulated imports of triple super phosphate and muriate of potash and allow private import of urea as required. Consistent with this condition, the government removed triple super phosphate and muriate of potash only from the import control list in 1990.

Fortunately, through general trade reforms, the government drastically cut the number of items on the control list, so that all fertilizers came off the list in July 1991.

#### *Delaying import liberalization while funding parastatals*

During the last decade, donor-endorsed fertilizer reform programs have focused, characteristically, on shifting domestic retail and wholesale trade from government agencies to the private sector and on cutting fertilizer subsidies. In Bangladesh and Ghana, for example, reform programs began with retail trade, then moved upstream over a matter of years to wholesale trade, leaving import reforms to the end. As a consequence, some program and project loans associated with fertilizer reforms continued to support fertilizer imports by government agencies — a practice transparently inconsistent with reform.

In some cases, such as in Bangladesh, governments eventually removed restrictions on fertilizer imports, completing reforms. In Turkey, another success story, import reforms ran ahead of World Bank recommendations. The World Bank's 1985 Agricultural Sector Adjustment Loan for Turkey proposed to end retail subsidies and to expand private

wholesale and retail trade, leaving reforms to allow private fertilizer imports to 1989. Meanwhile, the loan offered more than \$150 million for parastatal fertilizer imports. As events unfolded, Turkey freed imports in 1986, more than two years early. By 1990, the two parastatals that formerly imported and distributed all fertilizers remained with only 21 percent of fertilizer sales.

In other cases, reform programs failed as government agencies continued their control over fertilizer supplies. In Nigeria, for example, the World Bank attempted through a 1983 fertilizer loan to press the government to cut subsidies and to shift its monopoly on fertilizer import and distribution from one government agency to another (from Fertilizer Procurement and Distribution Department to National Fertilizer Company of Nigeria, a parastatal). The World Bank's \$250 million fertilizer loan paid for a substantial share of the fertilizer that the government imported and sold with subsidies during 1984-87. As of 1991, years after the end of the project, World Bank sources report that the government maintains its monopoly on fertilizer imports, and that subsidies continue at high levels. Project efforts to shift the monopoly from one government organization to another also failed.

#### **Recommendation**

The primary objectives of the following recommendation are to improve farmer access to fertilizer technologies and to promote faster agricultural growth. Saving government money is a secondary objective.

*Recommendation for governments: Remove tariff and non-tariff barriers on all fertilizer imports to give farmers unrestricted access to the full range of fertilizers available on world markets at near world market prices.*

Access to new products through imports allows private traders to compete through technical advice and product differentiation. Competition leads to faster technology transfer. In Turkey and Bangladesh, import reforms resulted in private introduction of new fertilizer products.

Complete liberalization of fertilizer imports entails not only eliminating quantitative controls but also giving all traders unlimited access to foreign exchange through the same foreign exchange market or window.

A good rule of thumb for a fertilizer reform program is that it be farmer-friendly. Import trade liberalization as proposed delivers benefits to farmers in the form of improved technology and convenient and reliable supply at near world market prices. To the farmer these benefits often far outweigh the negative impact that subsidy cuts might have on prices.



# 4

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## *Recommendations for Reform*

**E**asing restrictions on the import of agricultural inputs allows farmers to choose technology through markets. As described in previous chapters, donor advice in recent years has not always improved farmer access to new technology embodied in seeds and fertilizers available in world markets. Much advice offered in the name of reform has missed major issues, and some has even encouraged governments to tighten trade restrictions not related to externalities, taking choices away from farmers.

This is not to say that everything donors have done with respect to agricultural inputs trade has been wrong, but only that some aspects of project design and advice have been flawed. Donors must change their approach if they are to have a more positive impact on trade of agricultural inputs. This chapter recommends measures for donors to improve

their aid and advice for technology transfer and agricultural development.

*Recommendation 1. Review and revise advice for regulating agricultural inputs to focus on externalities.*

Donor advice concerning non-tariff barriers on trade of inputs has been inconsistent. Donors characteristically endorse general principles that trade barriers be removed when externalities are not an issue. But as illustrated in previous chapters, donor advice on specific aspects of trade regulation for inputs often encourages trade restrictions for reasons that have nothing to do with externalities. Table 4.1 presents a framework for analyzing common and donor-recommended trade regulations in terms of their focus on controlling externalities. Table 4.1 also proposes minimal regulations to control externalities.

Bringing donor advice on seed, pesticide, fertilizer, and other inputs trade into line with general principles may not be an easy task. Confusion and disagreement have lasted for years: for example, during the mid-1980s World Bank advice to Turkey assisted seed trade liberalization, while years later World Bank advice to some other countries endorsed seed trade restrictions. Given the number of staff within major donor organizations, including World Bank, Food and Agriculture Organization, and International Agriculture Research Centers, the community of people that contribute to policy advice is large and disparate. Policy reform within the donor community may take some time and effort

and, realistically, will not be a neat and decisive process.

*Recommendation 2. Add policy reforms for technology transfer through trade to all research and extension projects.*

Accelerating technological change is central to donor strategies for agricultural growth in developing countries. With few exceptions, donor advice and projects for technological change in agriculture focus on research and extension without addressing trade barriers through which governments actively block private sector introduction of new technology. If technological change is the objective, more could be achieved by improving multiple channels for introduction of new technology.

Research and extension projects designed to improve multiple channels for introduction of new technology would include:

- discussion of government restrictions on private imports of all classes of agricultural inputs; and
- conditions asking for removal of trade barriers that do not address externalities

Other aspects of standard research and extension projects would not have to be affected by these conditions, since little or no money is involved.

Projects for agricultural research and extension are incomplete and unbalanced if they do not take a holistic approach to the topic of technological change. A holistic approach would mean that project documents deal with all major channels for introduction of new technology, including private trade. With this approach, agricultural research and

extension projects may be more descriptively framed as agricultural technology projects.

*Recommendation 3. Use aid to support private rather than public sector imports of inputs.*

Donors could support competitive private imports of agricultural inputs by designing projects that (a) release foreign exchange to developing country governments to replenish the foreign exchange which these governments sell to private traders to import inputs; and (b) set conditions that governments remove barriers to competitive private imports of inputs. (Donors providing tied or in-kind aid could make arrangements for recipient governments to auction ownership of tied or in-kind aid to private importers before tied aid is spent in the donor country or in-kind aid leaves the donor country.)

When donors design aid to support private imports only, governments continuing to subsidize sales of inputs by government agencies not only do so with their own money but also lose aid. This approach creates pressure against subsidies that reinforces any conditionality.

During the last decade, many donor projects professing to promote liberalization and privatization of inputs trade have paid for continued imports by government agencies without even insisting on elimination of government import monopolies. In giving government agencies more inputs to sell, these projects set up unnecessary confrontations between donors and government staff over sales policies — prices and subsidies, whether government agencies sell to retail or wholesale

levels, etc. Whatever the outcome of such arguments over in-country trade, continuance of government import monopolies increases the likelihood that domestic trade will be privatized to monopolies or oligopolies controlled by governments.

Designing projects to support competitive private sector imports of inputs may lead donor staff to pay more attention to private inputs trade. Such projects present an option to maintain aid flows for inputs after government trade disappears, which might encourage both donor and government staff to let go of government trading activities more quickly. With the demise of government trade, projects supporting private imports would give donor staff channels to remain involved in policy discussions concerning inputs trade. Issues that might be expected to arise from time to time include: non-tariff barriers, emergence of oligopolies, and level of domestic protection.

*Recommendation 4. Revise procurement rules for private imports of agricultural inputs.*

During the last decade, in multiple credits and loans promoting import trade liberalization for fertilizers, seeds and other agricultural inputs, donor procurement guidelines have blocked use of funds for private imports.

For example, the World Bank's 1984 Agricultural Sector/Inputs Project for the Philippines provided \$149 million to finance imports of agricultural inputs, including fertilizer, animal feed, and other products. Standard World Bank procurement rules attached to the loan required international competitive bidding (ICB) for large purchases,

**Table 4.1: Regulating Agricultural Inputs: Reasons, Practices, and Reform Options**

1. Inputs which embody new technology	2. Externalities and public health concerns	3. Minimal regulatory options to meet concerns for externalities and public health	4. Common regulatory practices in WB client countries	5. Common donor advice	6. Reform options to facilitate private introduction of new technologies
<u>seeds and other planting materials</u>	(a) Imported seeds may carry pests or diseases, which could spread	(a) phytosanitary restrictions block introduction of pests and diseases	(a) phytosanitary restrictions are often too strict, needlessly interfering with private seed trade	(a) FAO is the leading donor organization advising countries on design of phytosanitary regulations; some private traders question FAO advice as too restrictive	(a) review and rewrite phytosanitary restrictions to focus on realistic disease and pest threats
	(b) widespread adoption of a new variety for a major crop could threaten regional stability if genetic diversity falls and/or the variety is susceptible to disease	(b) allowing private firms to import and introduce new varieties without government testing could be expected to increase genetic diversity and regional stability and to drive susceptible varieties out of the market	(b and c) many governments maintain short lists of varieties allowed for import or sale; governments test new varieties with attention to multiple criteria, including performance, which is not an externality	(b and c) donors, including the WB, commonly advise client governments to introduce or to continue with single-country positive lists of allowed varieties as described in the column to the left	(b and c) some options are as follows: (i) governments allow seed import and sale for any variety registered in the seed exporting country; (ii) governments allow companies producing seed in-country to sell seed of varieties that government has not tested or registered; (iii) governments list genes or varieties not allowed, with no limit on other varieties
	(c) plants with bio-engineered genes <u>could</u> present new problems	(c) governments could maintain negative lists of genes or varieties not allowed	NOTE: some governments enforce compulsory seed certification; seed certification does not address externalities or public health concerns	NOTE: donors, including the WB, advise and assist governments to establish seed certification agencies without clear advice that certification be optional	NOTE: make seed certification optional

fertilizers:  
chemical

(a) run-off into surface water promotes growth of water plants and alters fish habitat

(b) seepage into groundwater could make it dangerous to drink

(a and b) governments monitor quality of surface and groundwater; with low rates of fertilizer use in most WB client countries, problems are unlikely; problems may be due to human and animal waste more than to fertilizers; where problems are found, governments (especially local governments) may consider specific steps to reduce run-off and seepage from all sources

(a and b) governments monitor quality of surface and groundwater

(a and b) donors advise governments to monitor quality of surface and groundwater

(a and b) see column 3

NOTE: unrelated to any concerns about environmental externalities, many governments limit fertilizer imports by types and/or quantities

NOTE: major donors, including the WB, sometimes accept that governments limit types of fertilizer allowed for import according to advice of public sector scientists

NOTE: deregulating fertilizer imports and trade gives farmers more options to balance macro and micronutrients, which can reduce run-off and seepage into groundwater

fertilizers:  
inoculants and other biological products

(c) biological products could carry plant pests and diseases

(c) quarantine restrictions on imports

(c) ?

(c) see note above

(c) same as 3

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whether by private or public importers. Requiring ICB forces private traders seeking access to project foreign exchange to submit their procurement negotiations to oversight and approval by some government agency. In the mid-1980s, private traders in the Philippines had access to sufficient foreign exchange through functioning foreign exchange markets; accordingly, use of project funds lagged. Not until the World Bank relaxed its procurement rules to more liberally allow procurement by standard commercial practices did funds disburse smoothly against private sector imports.

Similar difficulties were experienced in the 1985 Agricultural Sector Adjustment Loan for Turkey. Private traders having access to foreign exchange through the market had no incentive to do paperwork, such as collection of three price quotations, to satisfy World Bank procurement rules.

Rules requiring competitive bidding or collection of three price quotations are appropriate for government procurement but are inconsistent with the philosophy and intent of trade liberalization. Donors promoting trade reform ask governments to sell their foreign exchange to all comers without reviewing or approving import orders. When donors wish to make project foreign exchange available for private imports of agricultural inputs, it would be consistent for donors to take their own advice, allowing private importers to use project foreign exchange on presentation of standard import documents acceptable to central banks or even customs records.

*Recommendation 5. Study private sector technology transfer.*

Preparation of this paper revealed areas in which little seems to be known about what might be important issues for agricultural development. Some areas for further study that could enhance policy advice include:

- Government controls on agricultural technology: This paper covers too many countries to do more than identify broad areas of concern. Further studies might be designed as cross-country studies of trade barriers for specific inputs, national or regional studies of trade barriers for all inputs.
- Response to trade liberalization for agricultural inputs: Over the last several decades, a number of countries have liberalized imports of agricultural inputs. With few exceptions, the consequences of reform for these countries are not yet well reported and analyzed. One of the exceptions is Lowell Jarvis' recent paper (1991) on Chilean fruit exports. Other reforms that could be studied include seed and fertilizer reforms in Turkey in the early 1980s, fairly comprehensive inputs reform in Bangladesh during 1988-90, and seed reforms in Mexico. Relevant measures of impact might include changes in private inputs trade, farm income, agricultural growth, consumer welfare, and exports.
- Impact of intellectual property rights legislation: The impact of intellectual property rights on agriculture in developing countries is a contentious issue, which may be taken as evidence that it is not yet well understood. Company and industry studies

could explore impact of various factors including presence or absence of legislation allowing intellectual property rights, import

restrictions, size of country markets, and level of development on private investments in agricultural research in developing countries.



**Table 4.2: Proposed Import Reforms for Agricultural Inputs**

<i>inputs</i>	<i>common trade barriers</i>	<i>suggested reform strategies</i>
seeds	many governments prohibit seed import and trade except for seeds of varieties which some government agency has tested and approved	eliminate controls on varieties of seeds allowed for import and trade except to deal with externalities; short negative lists of varieties not allowed may be sufficient
	many governments enforce over-tight phytosanitary restrictions	review phytosanitary restrictions and rewrite those which interfere with seed trade more than necessary to control realistic pest and disease threats
fertilizers	many governments ban or regulate private fertilizer imports; some governments limit types of fertilizers allowed for private import	remove fertilizers from import control lists (or add to lists of goods allowed for unregulated private import)
agricultural machinery	some governments limit private imports to makes and models tested and approved by government agencies; some governments protect local industry with high duties	remove agricultural machinery from import control lists (or add to lists of goods allowed for unregulated private import), ie, allow private traders to import any make and model without testing and approval by some government agency; reduce high duties
livestock feed and feed additives	some governments monopolize imports or control private trade in livestock feed or major feed components; most governments regulate some feed additives, including antibiotics	remove livestock feed, major feed components, and some feed additives from import control lists (or add to lists of goods allowed for unregulated private import); limit import restrictions to additives such as antibiotics and hormones which threaten externalities
pesticides	in many developing countries, time-consuming and expensive registration processes block introduction of new products including: products with low externalities; products which could replace other pesticides with significant externalities; and products already widely used in developed and regional countries	simplify registration procedures by focusing on externalities (toxicology data); leave efficacy for farmers and markets to decide, especially for products with low externalities; rely more on data and risk assessment from other countries; move toward automatic entry for products with low externalities that are registered in major developed or regional countries
veterinary medicines	many governments monopolize production and trade in some or all veterinary medicines including vaccines; most countries list veterinary medicines allowed for private import, and many list persons or companies allowed to import some veterinary medicines	focus trade controls on externalities; consider automatic approval for new medicines traded in specified other countries; establish objective criteria for identifying those allowed to import and sell (restricted) medicines
livestock, fish, and breeding materials	some governments restrict private import for reasons not connected with quarantine or environmental impact	remove barriers on private imports of livestock, fish, and breeding materials except for standard quarantine and environmental precautions justified by externalities

## Endnotes

1. Tables providing additional information on trade and trade barriers for seeds, fertilizers, pesticides, and other inputs for all Bank client countries with population over five million in 1990 are available from the author.
2. High tariffs are less often an obstacle. When high tariffs choke off trade in agricultural inputs, governments lose little and could even gain revenue from lower tariffs that allow more trade.
3. The term "seeds" is used in this paper to represent all planting materials, including cuttings, tree seedlings, bulbs, etc..
4. The position taken in this paper is that variety controls are more serious obstructions than phytosanitary restrictions and that for an equal amount of effort more trade liberalization can be achieved through attention to variety controls. Also, seed import is not the only channel for getting seeds of new varieties into a market. Companies can often get around phytosanitary restrictions by producing seed in-country. However, they cannot thereby get around government limits on varieties allowed for sale.
5. The environmental argument is presented in: Mooney 1979, p 77.
6. One World Bank staff member associated with Turkey's 1985 Agricultural Sector Adjustment Loan describes post-reform arrangements for seed imports as follows: firms are issued temporary permits with no expiration date to import and sell seeds of a new variety; if on testing the government seed agency can demonstrate that seeds are harmful, they can ask for an injunction banning sale; if the company appeals, the injunction is waived pending a court decision.
7. Taking three year averages from 1961-93 through 1986-88: Bangladesh fertilizer use increased by 13.1 percent per year from 33,000 tons to 713,000 tons; Brazilian fertilizer use increased by 11.0 percent per year from 275,000 tons to 3,760,000 tons; Chinese fertilizer use increased over the same period by 13.3 percent per year from 988,000 tons to 21,788,000 tons; Indian fertilizer use increased by 13.0 percent per year from 334,000 tons to 9,520,000 tons; and Indonesian fertilizer use increased by 11.8 percent from 138,000 tons to 2,213,000 tons. See: International Rice Research Institute 1991, p 250.
8. A recent study of fertilizer use in sub-Saharan countries presents evidence that foreign exchange constraints limit fertilizer imports: "some countries with severe foreign exchange shortages had significantly negative country dummy coefficients" in a regression looking at factors affecting level of fertilizer imports. See: McIntire 1988, p 55.
9. Some of the information in the paragraph comes through personal communication from Howard Cummer, Vice President, Canpotex, 1992.

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