SOYBEAN SITUATION IN BRAZIL

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Abstract

In this paper are discussed some aspects relating to the present and the future expansion areas of soybean cultivation in Brazil, soybean production and utilization, climatic conditions, soil acidity, liming and fertilizer application, utilization of soybean cultivars, cultural practices, weed control, the principal insects and diseases of soybean and their control.

Soybeans in the world

According to available statistics the United States is the major soybean producer in the world, accounting for an average of 64% of the world production in 1977/78. Brazil has also the largest soybean area under cultivation with alnost 52% of the land under this legume. On the other hand, Argentina shows the highest yield compared with other important producers. Only four countries were responsible for about 94% of the world soybean production in the 1977/78 period. These countries are the United States, Brazil, China and Argentina.

The world production of soybeans in 1980 was estimated at 83.5 million tons, showing a decrease of 8.7% over 1979. This decrease was mostly due to losses in the United States production which were not compensated by increases in the Brazilian production.

Soybean grain export in the 1977/80 period reached an average of 24.1 million tons, with a value of US$ 6,302.2 million. The United States is the main exporter, followed by Argentina and Brazil. These countries were responsible for 82.5% of the international trade in soybeans. China, in spite of being the third world producer does not participate in grain export. As grain importer Japan occupies the first place. This country followed by Germany, the Netherlands, Spain, Italy, China, URSS, the United Kingdom and France imported almost 82% of the available soybeans.

Soybean production in Brazil

Soybean was introduced in Brazil as experimental crop in 1882 in the State of Bahia by Gustavo D'utra, however this attempt was unsuccessful. In the State of Sao Paulo the crop was cultivated for the first time in 1892 by Daffert at Instituto Agronomico de Campinas. The highest yields were obtained by Japanese immigrants in 1908. These yields were further improved with the introduction of 50 North Anerican lines and cultivars in 1933. During the following years, soybeans were cultivated in small areas, mainly for home consumption.

In the State of Rio Grande do Sul, Craig started the soybean cultivation in 1914. This crop was here to stay as it was being utilized as hog feed which caused a rapid expansion in acreage and Rio Grande Sul the first State to export soybeans in 1949 (18,000 tons) . On the other hand, the State of Parana where soybean cultivation was initiated in 1954, is today (1983) the major state producer. Soybean production experienced a sharp increase during the period 1960/70, mainly due to the introduction of the double cropping system, wheat-soybean. The Brazilian soybean participation increased from 0.5% in 1954 to 16% in 1976 on a world basis. This increase was due to the high prices of soybeans (International) , availability of cultivars and production technology stemming from research work carried out mainly at governmental institutions. Consequently, the farmers were

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able to obtain high average yields, similar to those in the United States.

In 1980 the total area planted to soybeans represented 5% of the area of the country. During the period 1960/80 there was a great change in the areas planted to different crops. In the periods 1960/1964 and 1976/1980 the total areas under cultivation increased from 28.5 to 47.2 million hectares which represents an annual increase of 3.2%. The area under soybeans from 1960 to 1980 in Brazil increased at the rate of 26% annually. On the other hand the average annual increase of wheat was 9.2%, corn 2.7%, rice 3.2%, dry bean 2.9% and other crops only 0.3%. Soybeans represented 1% of the area under cultivation during the period 1960/64, and this figure increased to 16.2% during the 1976/80 period.

The Brazilian production of soybean in 1981/82 was around 13 million tons according to the latest available data. This total represented 23.3% in relation to the estimate for that season, and it was due mainly to the drought that affected the Southern States (Rio Grande do Sul, Sante Catarina, Parana and Mato Grosso do Sul) together with the restriction in the use of fertilizers, herbicides, insecticides, etc. caused by the unavailability of financial loans in relation to harvesting of crops in previous years. Subsequently there was a reduction of 3 % in the total area under soybeans during this year (1980/81).

Table 1 Production of soybeans in the states of Brazil in the 1969/70-1981/87 period

	Period							
	1969/70	1971/72	1973/74	1975/76	1977/78	1979/80	1980/81	1981/82*
States	1,000 ton							
Rio Grande do Sul (RS)	976.8	2,173.6	3,870.0	5,035.0	4,567.8	5,737.2	6,088.3	4,200.0
Parana (PR)	368.0	688.2	2,588.9	4,500.0	3,150.1	5,400.2	4,950.0	4,500.0
Mato Grosso do Sul (MS)	—	—	—	—	—	1,322.1	1,346.0	1,400.0
São Paulo (SP)	90.1	175.3	522.0	765.0	745.5	1,099.1	1,032.0	1,100.0
Santa Catarina (SC)	53.0	98.9	431.5	435.0	354.7	718.8	648.2	600.0
Goias (GO)	9.8	49.9	99.0	46.7	100.4	455.8	382.6	—
Mato Grosso (MT)**	9.0	27.9	307.0	209.4	479.1	117.2	224.9	—
Minas Gerais (MG)	1.8	8.9	57.6	165.5	137.1	289.5	279.4	—
Others	—	—	—	81.0	—	16.0	26.6	1,200.0
Total	1,508.5	3,222.7	7,876.0	11,237.6	9,534.7	15,155.9	14,978.0	13,000.0

* Estimate ; Source-IEA,IBGE.

** Includes Mato Grosso do Sul for the period 1969/70 to 1977/78.

As shown in Table l, the southernmost state (Rio Grande do Sul) contributed in 1980/81 to 40.7% of the total production but, in 1981/82 there was a reduction to 32.7%. On the other hand, Parana showed an increase from 33.2% to 34.6%, Santa Catarina from 4% to 4.6%, Mato Grosso do Sul from 8.7% to 10.8%, and in the State of Sao Paulo there was practically no difference in the level of production. The data show no substantial increase in the expansion of soybean production which is due mainly to the unavailability of loans.

Brazilian consumption of soybean meal in 1981 was 2.29 million tons, 15.2% lower than that of 1980, indicating that poultry and hogs suffered from this decrease. Soybean oil consumption in Brazil has amounted to 1.36 million tons approximately, corresponding to about 80% of available edible vegetable oil.

In previous years Brazil was a major soybean grain exporter but, today, it exports not only grains but also soybean meal and oil. Among the exports of soybean grain and its products the sale of soybean meal brought in more dollars than the others. On the other hand the export of grain declined in spite of increases in the average prices.

Crop characterization

Figure 1 shows an approximate outline of soybean production in Brazil:

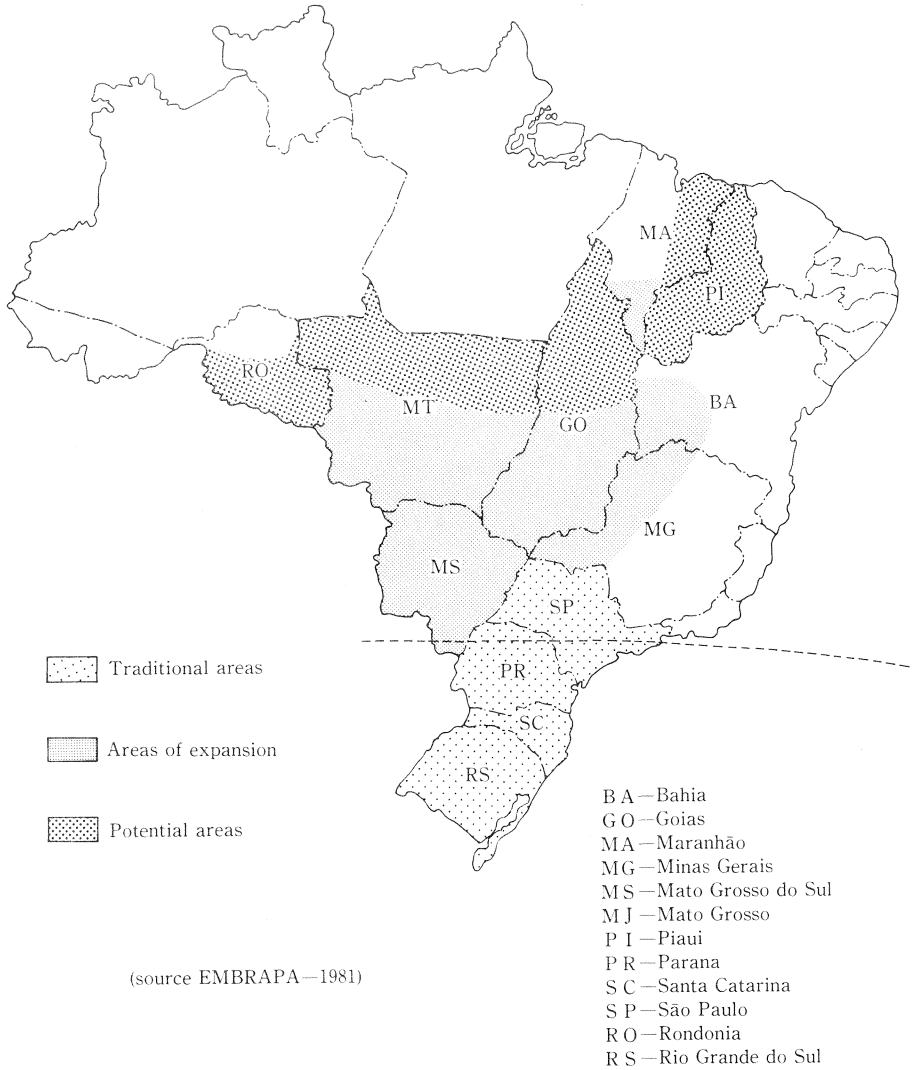

Fig. 1 Areas under soybeans and future expansion areas.

a) Traditional area; includes the southern States of Rio Grande do Sul, Santa Catarina, Parana and Sao Paulo, which produce approximately 89% of the Brazilian soybeans. With the advanced technology available presently the crop is completely mechanized from planting to harvesting. Improved varieties, are being utilized along with the control of weeds, diseases and insects and yields average 1.880 kg/ha.

b) Expansion area: includes the States of Mato Grosso do Sul, southern part of Mato Grosso, Goias and Maranhao, besides the western part of Minas Gerais and Bahia. Most of this area is characterized by acid soils, under "cerrado" vegetation. In several regions of this area soybean cropping is quite recent and the technology used has been exclusively developed in Brazil, mostly in Sao Paulo where a great part of the soybean area was cultivated on "cerrado" soils. In the area of soybean expansion in the States already mentioned the average yields are approximately 1.500 kg/ha.

c) Potential area: includes the northern part of Mato Grosso and Goias, southern part of Rondonia, northeastern part of Maranhao and Piaui. Field trials are being carried out to evaluate the possibility of planting soybeans.

Climatic conditions

Based on climatic parameters such as average annual temperature (Ta) = 17°C and (Ta) = 24°C, and annual rainfall indexes (Im) = -40 (Im) = 0, (Im) = 100 associated with cultivar requirements and behavior of commercial soybean planting, an ecological zoning for soybeans in Brazil was established including eight climate zones: A - suitable, B - suitable to marginal, C - moisture restriction, D - marginal, high temperature and humidity, E - marginal, excessive humidity, F - unsuitable, suitable, low temperature (Fig. 2) .

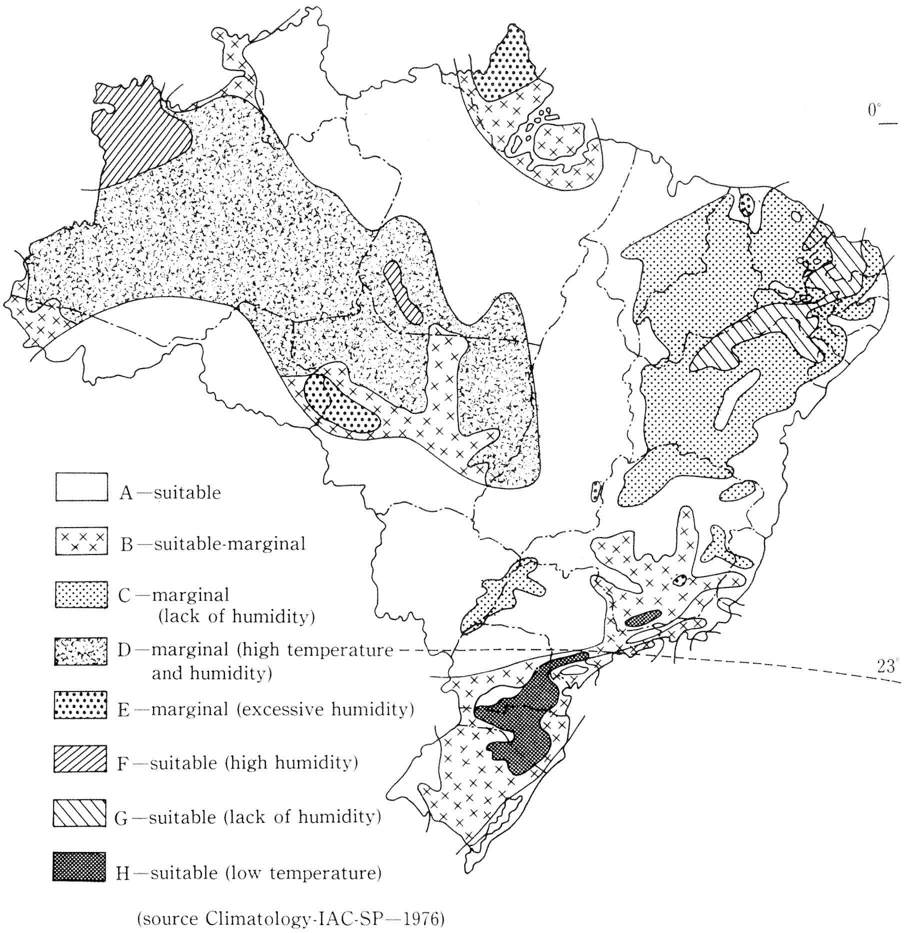

Fig. 2 Climatic zones.

Another aspect linked with the climate and related to the soybean expansion was the ecological survey showing that wheat could be planted from the southern border of Brazil to latitude 23°S. With government loans readily available, the farmers were able to buy equipment to mechanize wheat cultivation from planting to harvesting . With the same machinery they could plant soybeans. The possibility of double cropping (wheat and soybean) during the same cropping year, using the same fixed investment (land and machinery) was responsible for the increase of the area under soybean cultivation.

At latitudes lower than 23° S, soybeans are being planted in soils under "cerrado" vegetation, during the wet season. In the winter, the cultivation of new soybean cultivars with irrigation has become possible.

Soils

Initially, soybeans were planted in Brazil on a small scale where the slope of the land was not an important factor, because planting and harvesting were performed manually. Today with the expansion of the area, flat lands are preferred, as soybeans can be mechanized from planting to harvesting. The use of flat lands has an advantage in that the chances of erosion are minimum and there are better facilities for the transport of limestone, fertilizers, pesticides and grains. Land with slopes over 12% are not recommended for soybean cultivation in Brazil.

Soil acidity and liming

It is well known that soil acidity is a limiting factor in soybean production. As a rule, the increase in the soil pH by liming increases soybean yields from 30% to 100%. Liming increases the availability of phosphorus and molybdenum in the soils, reduces the toxic effect of aluminum and manganese and is a source of calcium and magnesium as nutrients for plant growth . It also promotes the establishment of *Rhizobium japonicum*, that fixes nitrogen symbiotically. The quantity of lime required to reduce the toxic effect of manganese is greater than that for aluminum.

Fertilization

Soils in which soybeans are presently cultivated originally have a low amount of phosphorus, with considerable variations in the level of potassium. Although as a rule, soil analyses are a good indicator of the soil fertility status, for soybean it is also important to take into account the behavior of the previous crops planted and the fertilizers used. Soybean plants are scavengers and when used in rotation with other crops they are able to utilize effectively residual fertilizers.

When soybeans are cultivated for the first time in acid soils, frequently nitrogen deficiency is observed, which is caused mainly by the lack of nodulation. Under these circumstances, nitrogen fertilization increases soybean yield. It has also been demonstrated that the nitrogen applied does not increase soybean yields in limed soil, or in soils where the availability of calcium, magnesium, phosphorus, sulfur and molybdenum is adequate, because efficient nitrogen fixation can take place.

In relation to phosphorus, the critical level in the soil for good production is 0.07 meq or 7 ppm (extraction with $H_2SO_4$0.05 N) . Only below this level is phosphorus fertilization recommended. In spite of the low initial phosphorus availability, it seems that fertilization over long periods of time (five or nore years) reduces the need for application to a low minimum for achieving high yields. Highest soybean yields are obtained when the soil potassium availability is equal to or higher than 0.12 meq or 48 ppm. Although there are only a few reports describing the yield response to potassium, 30 to 50 kg/ha of K_2O are recommended for restoring the soil supply and as measure to control pod mold (*Diaporthe phaseolorum* var. *sojae*)

Cultivars

In relation to daylength, since soybean is a short day plant, the response to photoperiod is the most important factor for the adaptation of a given cultivar. Daylength is closely related to the latitude, and this is well illustrated by the fact that cultivars developed for the South of the USA can become perfectly adapted to the conditions prevailing in Rio Grande do Sul. In this regard, when there were no cultivars developed by Brazilian breeders, in Rio Grande do Sul most of the growers utilized cultivars introduced from the USA, such as Hill, Hood, Major, Bragg, Davis, Jew 45, Hampton, Harde and Bienville. However, it must be mentioned that the cultivar Santa Rosa and Industrial which were originally developed by the Instituto Agronomico in Sao Paulo, contributed significantly to soybean developnent. Santa Rosa and IAC-2 cultivars were very important for the expansion of soybean cultivation. Both cultivars have a broad adaptability and Santa Rosa accounted for approximately 60% of the overall area cultivated with soybean in Brazil during the period 1973/78.

As there were no cultivars adapted to latitudes lower than 23°S, there was a need for the introduction of new germplasm, as no commercial soybean cultivars were adapted to the conditions prevailing in areas near the equator. The American cultivars at this latitude (23°S and lower) , show early flowering and the plant height does not allow mechanized harvesting. The best materials for late flowering, were the lines from the cross Hill × Pl 240,664 which were also efficient. These lines crossed again with American cultivars (Hill, Bragg, Davis Hampton, Tracy, and Lee) produced cultivars such as IAC-6, IAC-7, IAC-8, IAC-9, IAC-11, Tropical, Doko and Numbaira. Thereafter it was verified that some of these materials such as IAC-8, had a juvenile period, with a broader adaptation to planting date and latitudes compared with other materials. An important part of this feature is that when the materials are planted in November, soybean cultivars requiring 230 days or more to mature are likely to experience a lack of moisture at the pod filling stage, resulting in low yields. However the planting of IAC-8 in October was associated with comparatively stable yields when high moisture and rainfall periods coincided with the vegetative and reproductive cycle of the plant. Today IAC-8 is being successfully planted in Sao Paulo, Minas Gerais, Mato Grosso, Mato Grosso do Sul and Goias, and even at latitudes as low as 10°N (Ivory Coast) .

Other materials with late flowering were also identified, some of them being derived from mutations in commercial cultivars. Recently germplasm from Delta Experiment Branch Station (Mississipi) with a juvenile period has been introduced in the State of Sao Paulo. Cultivars derived from it show a performance similar to that of cultivar IAC-8.

Tillage practices

Three main systems of soil preparation are adopted in Brazil to plant soybeans:

1 Conventional : this system consists of deep plowing (almost 20 cm) followed by two or more diskings. The first disking aims at breaking down clods and reducing the quantity of weeds. The second disking is performed near the planting date in order to apply herbicides before planting if necessary. With the double cropping system (wheat and soybean) there is always a delay in the planting of one of the crops because of the lack of time to prepare the soil.

2 Minimum tillage : this system leads to less soil disturbance when compared with the conventional method especially in a double cropping system. Normally the operations consist of disking with a heavy implement followed by one or more diskings with a light implement. Unfortunately this practice in clayey soils causes compaction of the soil which restricts root development, reduces water penetration and promotes erosion.

3 No tillage : this practice consists of planting soybeans without seed bed preparation using a special machine that cuts the remaining of vegetation and leads to soil fragmentation. Thereafter seeds and fertilizers are being introduced. This system makes compulsory the use of dry herbicides. Experimental data show that yields are almost similar in any of the soil preparation systems.

However direct planting (no tillage) consumes less oil than others. Indirect benefits also have to be taken into consideration as in this system there is better erosion control and soil improvement.

Weed control

Weeds may depress soybean yield by 30% to 50%. High infestation of *Brachiaria plantaginea* may cause losses of up to 80%. Besides the direct injury caused by competition, weeds may host insects, pathogenic nicroorganisms and nematodes. The following are the nost common weed in soybeans :

1 Dicotyledons : *Acanthospermum australe, Acanthospermum hispidum, Amaranthus hibridus, Bidens pilosa, Commelina* sp. , *Euphorbia heterophila, Ipomea* sp. , *Portulaca oleracea* and *Sida* sp.

2 Monocotyledons : *Brachiaria plantaginea, Digitaria sanguinalis, Cenchrus echinatus, Sorghum halapense, Eleusine indica* and *Cyperus rotundus*.

Several measures are utilized for weed control, each of them being selected for specific requirements. Prevention of the introduction of new weeds starts with the careful selection of the seed lot. The infestation on a large scale of small bean (*Vigna* sp.) which has the same seed size as soybean may occur under such conditions. Machinery cleaning is an other important preventive measure to avoid the dissemination of vegetatively propagated weeds.

Cultural practices are undertaken to promote rapid vegetative development of soybean and to restrict weed growth. Crop rotation is another measure to alter the pattern of weed population to promote crop development.

Manual control through hoeing is impractical due to low efficiency. However, mechanical cultivation is widely utilized, because such a method in addition to controlling weeds also breaks the soil surface, facilitating water and air penetration. In spite of the high cost (about 10 to 20% of the total cost) and the hazards to the environment, herbicide application is the most common practice for weed control in soybeans. One of the most important reasons for the use of herbicides is the initial control of weeds during the early development of soybean plant, when competition is detrimental.

Pest control

Soybeans are attacked by a large number of insects, which may cause damage, depending on the level of infestation, growth stage, and pest control measures.

For several years, soybean growers have been applying large amounts of pesticides based on a systematic schedule, without checking if the insect was present or determining the level of infestation. This resulted in high production cost, environmental disruption, the surge of secondary pests and insect resistance to pesticides.

Nowadays, integrated control does not allow insect population to reach a hazardous level. Due to the availability of knowledge on the geographical distribution, biology, attack period, damage level, measures of control are considered adequate. The potential of biological control, pesticide selectivity and plant resistance to insects have contributed largely to the establishment of integrated control. Breeding programs are releasing cultivars with resistance to the most common insects pests, which should contribute to further promote the efficiency of current pest management.

Soybean caterpillar, *Anticarsia gemmatalis*, is the most common larva feeding on soybean leaves. The second nost important insect is the soybean looper, *Pseudoplusia includens*. For a long time it was considered that only one *Plusia* species attacked soybean. Now it is recognized that there are various *Plusia* sp. attacking soybean and they are known as the *Plusiinae* complex, with *Pseudoplusia includens* being the most prevalent species.

Amidst the lepidopterous larvae *Epinotia aporema*, bores the tip of the plant. The attack of this insect on soybean results in the increase of branching while the plant stature is reduced and the yield decreases due to damage of the racemes.

Stink bugs are by far the most important pests of soybean. These insects show a preference for the reproductive parts (pods) causing pod drop and seed injury. Besides this direct effect greening of the plants (abnormal maturation) also takes place. The most common species involved are *Nezara viridula, Piezodorus guildinii* and *Euschistus heros*. Control measures are only undertaken after evaluation of the pest population through entomological surveys conducted during the plant cycle.

Diseases

It is estimated that about twenty diseases are of economic importance for soybeans in Brazil among more than one hundred that may affect this plant. Among the bacterial diseases it seems that under the Brazilian conditions bacterial blight caused by *Pseudomonas syringae* pv. *glycinea* does not affect soybean yield, while the incidence of *Xanthomonas campestris* pv. *phaseoli* var. *sojensis* and *Pseudomonas syringae* pv. *tabaci*, when associated, may depress yields by 15% in susceptible cultivars.

Two virus diseases are of major importance, one caused by soybean mosaic virus (SMV) and bud blight caused by tobacco streak virus (TSV) . The soybean mosaic virus has several hosts and is transmitted by a large number of aphid species. The SMV causes darkening of the hilum which spreads to the seed coat. In certain seasons this symptom causes rejection of seed lots as foundation seeds for planting.

Bud blight is potentially a hazardous disease due to the considerable yield reduction associated with the disease. However two facts make bud blight a disease of low economic importamce. Firstly there are few host plants, and the vectors, *Frankliniella schultzei* and *Frankliniella rodeos* are not too common under the Brazilian conditions.

The control of SMV is being performed by introducing resistance into commercial cultivars in breeding programs. The source of tolerance to bud blight was obtained recently. The use of tolerant cultivars will probably allow soybean production to be stabilized in the regions affected by bud blight.

Frog eye caused by *Cercospora sojina* is by far the most important and common fungus disease, which occurs from Rio Grande do Sul to Goias and Mato Grosso. The fungus attacks the leaves, pods, seeds and branches causing severe yield reduction, depending on the climatic conditions and susceptibility of the cultivar. Cultivar resistance is the most practical way of overcoming this disease. Downy mildew caused by *Peronospora manshurica*, brown spot by *Septoria glycines* and target spot by *Corynespora cassiicola*, are of common occurrence. However the economic damage caused by these fungi has still to be evaluated, but does not appear to be important.

Soybean rust, *Phakopsora pachyrhizi*, is a foliar disease of soybean which has been identified in Minas Gerais, São Paulo and Parana. The soybean plant shows three typical changes in response to rust fungus infection : tan changes - characterized by light brown lesions with heavy sporulation; reddish brown changes - characterized by reddish brown lesions with light sporulation, and 0 (zero) changes - when there is no evidence of lesion formation.

Brazilian and Puerto Rican isolates have induced changes of the reddish brown type in soybean but the tan type has not been detected. The incidence of soybean rust has not caused significant damage since the attack mostly occurs at the final stages of the plant cycle. The possibility of changes in the genetic constitution of the fungus which could become more pathogenic even with the formation of tan type changes should not be overlooked. This could pose a serious problem for soybean production in Brazil.

Among the soil-borne fungi *Rhizoctonia solani* is the most important as it lowers plant population and wilting generally occurs during the flowering stage. This disease has been cited as occurring in areas of Rio Grande do Sul, Santa Catarina, Parana, Minas Gerais and Mato Grosso. The only practical way of controlling the disease is to promote crop rotation with Gramineae, deep plowing soon after harvest and the use of systemic fungicides which may lower the inoculum potency, since cultivars tolerant to this disease are not available.

The fungi that decrease seed quality are *Colletotrichum dematium* var. *truncata* and *Phomopsis sojae* (*Diaporthe phaseolorum* var. *sojae*), which occur where soybeans are planted. They cause seed rot in periods of high moisture during plant maturation and when harvest is delayed.

Nematodes

In a nematode survey, thirteen nematode genera were detected in association with soybean plants. The most harmful species are the root knot nematodes *Meloidogyne javanica* and *Meloidogyne incognita*. According to observations, the latter predominates in areas in which soybeans have been cultivated for many years, while *Meloidogyne javanica* is prevalent in newly cultivated areas mainly "cerrado soils" and in areas where soybean is cultivated in rotation with pastures and sugarcane.

If the nematode attack is associated with water stress, losses are high. It is very important that nematodes be controlled because soybean is an important economic rotation crop and this crop could be planted, especially late cultivars that do not require fertilization, in rotation with other crops to which fertilizers had been previously applied. Planting corn, sugarcane, and rice after soybeans can reduce significantly the amount of nitrogen applied, hence decreasing the cost of production. Nematodes have been controlled on a small scale in the State of Sao Paulo by rotation with *Stizolobium atterrimum*. Screening cultivars for resistance to the two species has already been undertaken and a breeding program has already been initiated in some states.

Cultural practices

1 Spacing and plant density : Soybean is seeded at a depth of 5 to 6 cm in sandy soils and 3 cm in clayey soils where there is a risk of crust formation. Plant population is maintained at approximately 350,000 plants/ha with a row spacing of 60 cm and plant density of about 20 plants/meter. Under special conditions such as early plantings for double cropping, the row spacing is reduced to 40-50 cm in order to increase the plant height.

2 Seeding period : The planting period is the most important parameter for successful cultivation of soybeans. The planting period depends mostly on the soil temperature for seed germination, environment temperature during the life cycle of the plants, daylength for flowering, moisture chiefly for pod filling and dry period for maturity and harvest.

In latitudes lower than 23°S if planting is performed in the second fortnight of November, plants will show good vegetative growth. Even early cultivars (110 days) will develop adequate plant height for harvesting because the temperature, daylength and moisture are favorable for plant growth and production. However, cultivars of medium and late cycle (130-140 days) , in spite of a good vegetative growth may be subjected to drought during the pod filling stage in February. Therefore growers tend to choose early cultivars, and are encouraged by the prospect of double cropping during the same year.

To reduce the risk of potential high losses in large areas the utilization of soybeans with at least three different cycles is recommended. Both field trials and large scale planting have shown that the best planting date for late and medium cycle soybeans (130-140 days) with a juvenile period is October. In the Southern States planting time extends from October to December. The late cultivars are planted in October and December whereas the early cultivars are planted in November because of the favorable climatic conditions.

Perspectives

A reasonable amount of information on the major components of soybean production in the traditional areas has already been obtained. To maintain the present yield level, emphasis is being placed on crop rotation, soil conservation and measures to increase soil organic matter by research and extension workers as well as growers. The efficient use of lime, fertilizers and pesticides associated with cultivars with a higher level of resistance to diseases and pests, drought and acid subsoils will allow soybean producers to continue to plant this crop economically.

In the expansion area (central Brazil) , in soils under "cerrado" vegetation, there is a possibility of cultivating soybeans over an area greater than that planted to other crops in Brazil today (Fig. 1)

The "cerrado" area has been easily converted into regular cultivated land due to the expertise already gained in Sao Paulo State where during the period of 1965/75 almost all the "cerrado" land was converted into cultivated land. Presently such soils are extremely fertile. The expansion of soybean cultivation in central Brazil depends on the availability of financial loans.

If the northward trend of soybean production were to continue in the near future, it can be anticipated that the central part of Brazil may become the major soybean-producing area in Brazil.

Discussion

Dutt, A. K. (India) : What is the soil pH and the exchangeable aluminum content in the soybean expansion area in Brazil?

Answer: The exchangeable aluminum content is 1. 2 meq/100 gr.

Sadikin, S. (Indonesia) : Are there liming programs?

Answer: Yes.

Wang, J. L. (China) : What is the proposed cropping system for the newly opened area of soybean as well as methods of soybean management?

Answer: The methodology proposed for soybean cultivation in the newly opened areas is as follows: 1. In the first year, lime application (2-3 ton/ha) after clearing the land. 2. Fertilization with phosphorus and potassium (0-20-10) at the rate of 0.2-0.3 ton/ha and inoculation with *Rhizobium japonicum*. 3. Utilization of new cultivars (IAC-6, IAC-7, IAC-8, Numbaira, Doko and Tropical) which show a broad adaptation in relation to planting date and latitude. 4. Chemical control of weed and insect pests if needed. 5. Mechanization from planting to harvesting. The cropping system adopted is sole cropping during the wet season (September-April) for 3-5 years and thereafter rotation with corn and other grain crops.