

RESEARCH REPORT

# Food Self-Sufficiency in North Korea

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## PREFACE

I have been working on problems of food strategies in the Latin American setting for more than two decades. Together with colleagues at the Ecodevelopment Center and other institutions in Mexico, we have contributed to the on-going debate on the advisability of food self-sufficiency as a viable strategy. As the discussions advanced and the positions hardened with the deepening of the economic crisis, it became obvious that those of us advocating food self-sufficiency would have to find new ways to make our arguments more persuasive. An objective evaluation of the experiences of nations outside Latin America was one such approach.

North Korea might at first appear an unlikely choice for comparison. Its well-known commitment to self-reliant development (*Juche*) was shrouded in mystery. Although many official speeches of Kim Il-Sung were available, little concrete information was available to substantiate the impressive claims made in the official propaganda; and our skepticism was aroused by the dearth of social science literature other than the obvious apologies for the regime. But the few materials that were available suggested that it might be worthwhile looking further into the matter.

Through Mexican diplomatic and university channels I solicited permission to visit the Democratic People's Republic of Korea (DPRK). I was able to arrange for a visit to the Academy of Social Sciences in the DPRK for three weeks in July 1985 to examine agricultural development and the food system. Support for this trip came from the National Science and Technology Council, the Metropolitan University, and the Ecodevelopment Center, all Mexican institutions.

My visit began inauspiciously with the normal packaged mixture of intensive philosophical discussions of the *Juche* idea and visits to museums and historical sites. After some insistence, I was able to persuade my hosts to alter my program radically to include several lengthy visits to agricultural collectives and food markets. I also negotiated a substantial modification in their normal procedures to permit me unstructured and unplanned interviews with people selected at random in both urban and rural settings. The original program was further broadened to include special visits with technical and academic personnel in a number of key agricultural development and food systems institutions.

Our discussions were lengthy. In spite of my guide's lack of understanding of the reasons for my simple-minded questions and concern with detail, the people in the communities and markets displayed considerable patience. With help from local minute-takers, I was able to retrace the contents of important community meetings and follow bureaucratic procedures in some detail. I was also able to talk with consumers at random in urban shops, and to learn first hand about peasant markets. My hosts appeared quite concerned with my questions, and diligently searched for information they did not have at their command. At the same time, however, they were insistent in conveying their own criticisms of my approaches to information and my disregard for official *junchean* methodology

In general, I felt that I was able to obtain a fairly good first impression of the food system and the process of rural development. Compared with other visitors to Korea, I enjoyed a richer and more informative visit because I was able to negotiate considerable freedom of movement and persuade my hosts of the importance of learning as much as possible about the food system. Unfortunately, one point of contention was never resolved: there is virtually no official information coming directly from North Korean authorities and social scientists on their development experience; authoritative sources in the DPRK argue that such secrecy is a necessary consequence of the hostility and potential aggression which they fear from their southern neighbors and the United States. No flexibility was displayed on this point despite repeated high-level discussions of the matter. Therefore, most of the aggregate data in this paper is freely available to scholars in the West. The production, consumption, and trade data are derived from FAO sources. In those cases where official information or personal findings are cited, it is noted explicitly.

Finally, I would like to express my appreciation to Jonathan Fox and the staff of the Institute for Food and Development Policy who generously offered comments on earlier drafts. I wrote this paper while I was a fellow at the Center for US-Mexican Studies of the University of California, San Diego. Of course, all responsibility for the present formulation rests with me.

## INTRODUCTION

This paper outlines the history of North Korea's attempts to achieve food self-sufficiency. After forty years of independence and thirty years of economic growth, the country has achieved this goal as part of a larger strategy of inwardly-based economic growth based on precepts of self-reliance. The North Koreans started to reorganize agriculture immediately after the 1953 Korean armistice to respond to the productive demands created by their policy of self-reliance.

They did not choose an extreme version of this approach (autarchy) which would have involved no trade with the outside world. Rather, they sought to produce those foods which could be efficiently produced given their climate, resource endowment, and socio-cultural requirements. Throughout the period since the end of the Korean War they have engaged in international trade in foodstuffs, but have never eased up on their commitment to maintain a balance or a surplus on their foreign account in food and to be able to feed themselves entirely from national supplies. It appears that they have been generally successful in this regard for the past decade.

The paper begins with an introduction to the historical situation in which the DPRK was founded and began its process of agricultural transformation. The agrarian reforms and initial productive structure are briefly described before reviewing the history of agricultural production and trade. The Koreans emphasize the importance of the three revolutions in the countryside--the ideological, cultural, and technical--as crucial in achieving the advances which are evident to any observer.

An analysis of the changes induced in these areas provides some basis for judging the relative roles of productive and political forces in the process of achieving self-sufficiency. Additional information on recent developments to improve productivity and raise output is reviewed. The scant evidence on consumption patterns available from local observation and FAO documents is also presented. Finally, an evaluation of the North Korean experience is essayed with a view to stimulating more discussion of the value of food self-sufficiency as a goal for other Third World countries.

## 1. THE RURAL HERITAGE: JAPANESE COLONIALISM AND INDEPENDENCE

The Korean peninsula was formally occupied by the Japanese for 35 years, from 1910 until the end of the Second World War. During that time, its economy was molded to suit the aspirations of the colonial power. Although Korea experienced rapid industrialization, it only contributed to strengthening Japanese control and dislocating Koreans; the southern part of the country was reshaped to produce rice and light consumer goods for local needs and for export to the colonial market, while the north witnessed the establishment of heavy industries to support continuing expansion further north into Manchuria. Rural property was highly concentrated in the hands of landlords and most peasants were tied to the land through onerous bonds of tenancy.

It is not surprising that an anti-Japanese guerilla movement emerged to unseat the invaders. A unified national liberation front emerged during the 1930s among broad segments of the workers, peasants, and students. With the Soviet defeat of the Japanese in 1945, the moment was propitious to replace the colonial power with a national government. This probable sequence was prevented by the Soviet acquiescence to an American proposal to divide the country. This pact became the basis for a series of political machinations which assured the division of the country into two antagonistic regimes.

In the northern half of the country, which became the Democratic People's Republic of Korea (DPRK), Soviet forces handed control of major installations and institutions over to local Korean organizations formed during the liberation struggle. A long history of cooperative traditions in agriculture and the war-created conditions proved conducive to revolutionary changes in the rural sector (Suret-Canale and Vidale 1973:41-42; Brun and Hersh 1976:198). Local people's committees implemented a series of social and economic reforms designed to regain control of the territory by nationals and distribute property and income more equitably. Popular support for these reforms in the rural areas was particularly easy to understand.

Throughout the Korean peninsula control of the land was highly concentrated in the hands of a landlord class and the north was unable to supply its own food needs because the economy had been reshaped to serve the needs of Japanese western expansion towards Manchuria. Three-quarters of all rice had been sown in

the South, primarily to supply Japanese demands. Prior to reform, 46,000 landlords--4.8 percent of the agricultural households in the north--occupied 58.2 percent of the cultivated land, while the 720,000 poor peasant households (56.7 percent of the total), were cultivating only 5.4 percent of the land area (Noumoff 1979:29). It is not surprising that most Korean landlords and Japanese colonialists fled to the south as a popular revolutionary movement began to consolidate in the north.

## 2. THE HISTORY OF AGRARIAN REFORM

### a) The First Agrarian Reform

Even before the first agrarian reform law was promulgated on March 5, 1946 the burden of the colonial heritage on the peasantry was reduced. On October 10, 1945, just two months after the liberation, tenant rents were reduced to 30 percent of harvest yields and taxes and other levies were made the responsibility of the landlords. The land reform measure of the following year placed a five *chongbo* (one *chongbo* = .99 hectares) limit on private individual land ownership.

Implemented in less than one month, the reform dramatically restructured rural society and economy. Thus, in one single blow the landlord class was eliminated as an effective economic and political force in the villages. A substantial proportion (90 percent) had already fled to the South; a few of those remaining opted to participate in the redistribution program, while another small group was relocated, reportedly minimizing "the level of violence around the reform" (Halliday 1983:121). The immediate economic impact of the reform was to reduce the average size of holdings to 2.1 *chongbo*, increasing the average holdings of poor peasants and substantially reducing the concentration of landholdings. About 725,000 households received land under the program (Pak 1983:217).

Measures to improve productivity and stimulate cooperation among producers complemented the land distribution. Land banks and consumer cooperatives were established while mutual aid teams, rural production teams, and labor brigades were organized to promote cooperation and facilitate the amalgamation of small plots into larger units which might be more productive. Replacing rent payments and other levies, a 25 percent tax-in-kind was imposed and for a short

period some compulsory sales of food grains to the state were required. The net impact of the reforms on agricultural output and real incomes was apparently favorable, in spite of the limited public resources allocated to agriculture--11 percent of public investment. Official statistics report that in 1949, the cultivated area of food crops increased by only seven percent, the value of gross agricultural output rose 51 percent in comparison to 1946; grain production increased 41 percent, livestock 85 percent, and sericulture (silk) 139 percent. Workers' wages rose by 53 percent during the same period (Kim, 1979:30-1).

A critical survey of DPRK policies concludes, on the basis of somewhat different data for this period, "that the increases in agricultural production ... were mainly the product of recovery from the totally abnormal conditions that developed as a result of World War II, Japanese defeat, and the subsequent political upheaval. The establishment of political order and firm measures producing economic stability were the chief accomplishments, and there is no denying their importance" (Scalapino and Lee 1972:1031). When compared to other thorough-going agrarian reforms in this century (e.g. USSR, Mexico, Cuba), the North Korean experience during this first period appears quite successful, both in terms of the rapidity of the productive response and popular support.

#### b) Collectivization

The 1950-1953 war had a devastating impact on the North. The blanket bombing had destroyed virtually all of the industrial plants and irrigation systems, while only two multistoried buildings remained in the capital city. In the rural areas, dispossessed landlords returning with the invading troops from the South are reported to have heightened the effect of the killing from bombs and other causes by massacring Party cadre involved in the agrarian reform.

After the war the process of rural reconstruction began with an explicit commitment to move in the direction of cooperatives in all aspects of economic life. In certain ways, agriculture led the movement; during the war collectives had begun to function out of necessity, but later they were accelerated because of an ideological commitment to this new form of organization (Pak 1979:440). Collectivization of agriculture proceeded rapidly. Although private farm production accounted for 92 percent of all agricultural production in 1953 (with state farms producing most of the remaining value), the private units had been



entirely absorbed into collectives by 1958. In 1959, new rules eliminated even the facade of private land ownership and all production was organized by collectives and state farms.

The move towards collectivization started by building upon traditional forms of cooperation among peasants--mutual aid teams which shared labor and draft animals. The massive loss of human and animal life during the war made this particularly urgent in Korea, and the regrouping of land in the process would facilitate the move towards mechanization. Premier (now President) Kim Il-Sung (February, 1954) also highlighted the political motivation for this push: "The remnants of feudalism and capitalism still lie deeply embedded in the countryside. Unless challenged, these remnants would threaten the socialist system itself."

After the war, three types of collective farms coexisted:

Type I. Permitted: the private ownership of land, animals and agricultural implements; individual tillage and reaping of private plots; some collective use of tools and animals and pooling of labor, with compensation to owner.

Type II. Permitted: the private ownership of land; draft animals and agricultural implements to be privately owned or purchased by the cooperative; collective use of land and pooling of labor in sowing, plowing, and harvesting; 20 percent of crop for distribution according to land contributed and 80 percent according to labor.

Type III: Transferred real control of the land to the collective, as the distribution of output was determined solely on the basis of labor contribution; permitted collective use of land and all means of production; called for cooperative farm operation.

In 1958, the more 'primitive' types were consolidated into a single organizational model of the most advanced 'socialistic' Type III. The transition to this third type was relatively rapid and peaceful in Korea, compared to the violence in some other countries (USSR, China) and the persistence of private farms in others (Cuba). The reasons for this rapid transition were: 1) the massive departure of political dissidents during the first decade which had contributed to weakened opposition among rural social forces; 2) the experience peasants had gained in their recent struggles; 3) the tradition of using mutual aid teams;

4) the political responsibility placed on the peasants by the party; and 5) the extreme hardships which the peasants were subjected to as a result of the massive dislocation and destruction wrought by the war (Kim Il-Sung IV/7/56, Works, Vol. 1:645-7).

Since 1959, all means of production in rural areas have been owned collectively or directly by the State. In the cooperatives, as they are called in the DPRK, the land, draft animals, agricultural machinery, and implements are owned collectively. Production costs, the tax-in-kind (which was reduced to 20.1 percent in 1956, 8.4 percent in 1959, and zero in 1965), the common reserve fund (10-15 percent of the product), and a socio-cultural fund (2-3 percent) are set aside before distributing the product to the members based on their qualitative and quantitative labor contribution. Private cultivation of small vegetable gardens and fruit trees on lots of 50-90 square meters (30-50 *pyong*) is still permitted, as are domestic animal and bee production for home consumption and sale at the regional peasant markets.

The transition from Types I and II to the Type III organizational form contributed to an increase in the size of the cooperative farms. In 1958, this tendency was accelerated by Cabinet Decision No. 125, which provided for "the amalgamation and expansion in the scale of operations of agricultural cooperatives"; it was implemented in just two months by uniting all the cooperatives in each *Ri* (village - the smallest administrative unit) into a single cooperative. As a result the number of cooperatives declined from over 16,000 in 1957 to less than 4,000 by the end of 1958, with the average size jumping from about 100 to more than 460 *chongbo* and from 63 to 275 households per cooperative. The *Ri* based cooperative farm system also consolidated agricultural consumers' and credit cooperatives under its management, to become an integrated economic unit and the lowest decision-making body in the agricultural production system.

The motivations behind these structural changes were clear. The Type III organizational form facilitates and simplifies control of the productive unit by the planning authorities and permits more responsiveness to national economic and political needs. They also contribute to improving productivity, by regrouping land into larger units which could be efficiently mechanized and where technical and scientific resources could be effectively deployed. Irrigation programs, which were a high priority in order to raise output, would also be better planned and

implemented in the larger units. They are still the basic unit of farm production today, fundamentally unchanged from their initial organization some thirty years ago.

The rapid move toward socialist collectivization is directly related to the struggle for self-sufficiency. It was the subject of an intense ideological struggle within the DPRK, as evidenced by Kim Il-Sung's comment that "Some people think it strange that the agricultural cooperative movement is progressing rapidly in our country." Many within the party argued that the rural transformation should proceed more slowly, as had been the case in the USSR. But Kim and his group were insistent that the technical revolution that had begun would eventually be stymied by an outdated consciousness: "Without making a cultural revolution, the technical revolution cannot be carried out in the rural areas..." (Kim, Speech, VI/11/58, Works, Vol. II:156).

These must go hand in hand, Kim argued, with an ideological transformation based on the precepts of *Juche* and *Chajusong*. *Juche*, formally enunciated as a guiding principle of Korean development in 1955 (Kim, Speech, XII/28/55, Works, Vol I:583-93), is generally translated as self-reliance, while *Chajusong* is explained as personal independence and confidence. The first concept might be best explained as a combination of the triad, self-sufficiency, self-reliance, and self-confidence. The second stresses the responsibility of the individual for his own life. One insightful analyst has summarized the interaction of the two "as the concept of both national integration and an extension of the horizon of man's ultimate capacities" (Noumoff 1979:33).

In the Korean setting, internal ideological opposition to these moves in rural areas was ended by according primary importance to the notion of self-reliance and emphasizing the key role of rural production in economic development. The goal of food self-sufficiency, however, could not be achieved without profoundly altering the organization of the producers and their resources in order to permit a much higher level of technical advance to be incorporated into every aspect of the production process. This emphasis on raising productivity, however, could not be supported by public investment, which was being used primarily to stimulate heavy industry.

### c) State Farms

State farms were always regarded as the most advanced form of social organization in the rural areas, examples of "ownership by the whole people." Even while the cooperative movement was advancing, it was clear that the Party perceived it as yet another transitory organizational form in the advance towards communism. It was recognized, however, that this was a dramatic change that would require a profound advance in the technical, cultural, and ideological conditions prevailing in the rural areas before it could be implemented. During the past thirty years since collectivization was completed, there have been frequent discussions about the desirable rhythm and the preparedness of the peasantry for this transition.

A state farm is conceived of as the rural counterpart of an industrial factory. To fulfill its functions, the farm must generate the resources to guarantee its workers a relatively comfortable living standard on a level comparable to that of other Koreans. On the production side, there must be sufficient mechanization and routinization of the labor process to limit the work day to eight hours and to alter compensation schemes to make them sufficiently flexible to assure adequate quality control. These material preconditions will make the transformation of co-ops into state farms a lengthy process. The workers on a state farm would also have to display ideological consciousness considerably higher than the prevailing norm, since they would be responsible for maintaining production levels and productivity norms without the accounting systems used to calculate incentive payments on the cooperatives. In the 1970s there were frequent criticisms of state farm operations: farm equipment was often misused or left in disrepair and the level of ideological development was also disappointing.

In 1985, North Korean policy-makers agreed that it was still premature to make the transition. At present, some party members are even pressing for the reconversion of the several hundred state farms to cooperatives because they argue that salaried rural workers are less productive than peasants in the cooperatives. This reconversion is not likely to occur because it would occasion a decline in living standards for the people involved as wages would then depend directly on the value of output which is often insufficient to support existing wages scales. It would also raise difficult questions about the forward march of the transitional process.

Some of the state farms that presently exist are in the harshest climates in the country where special inducements were needed to ensure the creation of new enterprises. Others are responsible for some kinds of production particularly well-suited to factory organization, as is the case of fruit plantations and modern poultry and hog-raising establishments. These farms have received a relatively generous endowment of machinery and the most advanced systems to raise productivity. In other cases, the state farms have been established as part of an on-going process of experimentation with the problems of the transition to communism in agriculture. State farms do not yet occupy 10% of the cultivated area in rural North Korea. The eventual transformation will be undertaken with great caution and is still far off.

### 3. THE CHONGSAN-RI MANAGEMENT METHOD

The change in organization of production in agriculture also required new management techniques. In the years following complete collectivization, discontent grew at all levels as agriculture did not meet its output targets. The cooperatives were burdened by increasing debts and poor management. Labor shortages became particularly acute as mechanization advanced slowly and the farms received inappropriate machinery. In the system of top-down management, policies and production quotas were simply transmitted from the central planning and administrative authorities to the Ri through the Agricultural Ministry Guidance Bureau offices at the provincial and county levels. Duplication of efforts by party and People's Committees at the county level resulted in a bureaucratization of methods and lack of attention to the specific conditions of each cooperative.

The most serious criticisms from within the Party were directed at the distribution system. It was a crucial link in the effort to sustain morale and increase productivity but was not adequately responding to peasants' needs and demands. Work points, which should have been collectively calculated each day in the fields, were often fixed by bureaucrats in county offices. Productivity campaigns based on work-team emulation were often ineffective because they were predicated on an improvement in the collective welfare, which was not always forthcoming.

A new management system, known as the *Chongsan-ri* Method, was implemented in 1961 to address these problems. It was based on greater participation of lower level basic units in plan implementation and management. The essence of the new method

...lies in the aid given to inferior units by superior units, in the assistance of the lower by the higher, in the constant proceeding to actual work sites by party cadres, and their deep understanding of the realities, their search for the correct methods of solving problems, their giving priority to the political task and matters concerning the masses, and their ensuring the execution of revolutionary tasks by mobilizing the self-conscious enthusiasm and creativity of the masses (Kim Il-Sung, "On the occasion of the twentieth anniversary of the foundation of the Korean Workers' Party," cited in Scalapino and Lee 1972:1099).

In synthesis, the new system placed responsibility on the party workers to approach the peasants, to seek guidance and learn about the reality from them before emitting orders and formulating plans.

The new approach also involved a fundamental reorganization of the role of the Cabinet (committee of ministers) itself. The previous pattern of direct intervention was replaced by a hierarchical structure of command. The Administrative Council (cabinet) provides directives for agricultural development to the national Agricultural Commission which operates through State institutions (Co-op Farm Bureau, Guidance, Sanitation, Sericulture, Construction, etc.) to establish long-range policy and to direct scientific research and technological development. These guidelines orient the Provincial Agricultural Management Committees which, in turn, develop operational procedures for the County (*Kun*) Committees. They are the fundamental link between the cooperative and social ownership in the new structure; emphasis was placed on integrating leadership, planning, and supervision at the county level.

The *Kun* Agricultural Management Committees (composed of representatives from county people's committees, local technical organizations, and village cooperative executives) are a key unit in the post-1961 management structure. Charged with correcting the previous problems of bureaucratization and centralism, the *Kun* Committees thought that close coordination between the county and the village would facilitate the incorporation of technical and scientific advances into

production by directly involving the work teams. They were responsible for managing the machine tools, tractors, and other equipment to be used within the county. They would supervise the local irrigation system and the distribution of much of the other government provided equipment available to the co-ops. In coordination with the provincial committee, they would establish factories to meet regional needs for farm equipment, some inputs (spare parts, fertilizers, tools, etc.) and even to process some industrial crops. This move to centralize a substantial degree of responsibility at the county level was designed to counteract the "administrative-technological omnipotence" which had characterized the provision of machinery and industrial services to the co-ops in the past.

The decentralization that this process involved also facilitated more efficient central administration of the provinces...The granting of greater responsibilities to the local state organs left the central ministries free to concentrate on larger-scale national industries. It also promoted the development of local industries, for the economic effect of the establishment of provincial economic organs and the degree of independence and initiative it conferred on the provinces allowed a more rational utilization of the resources and potentialities of local communities (Brun and Hersh 1976:329-30).

The Kun Committees are also responsible for preparing production plans for the cooperatives under their aegis. The work teams are expected to evaluate these plans and formulate their own work program, specifying their work programs and output targets. These are aggregated into a single program for the co-op and discussed at a general assembly before passing to the county level. These meetings can be effective mechanisms for the farmers to discuss their grievances and ideas with cadres and managers from other levels. In two co-ops I visited, members reported that the detailed production plans for 1986 occasioned lengthy collective discussions of output and productivity targets; some modifications, which were later accepted at the Kun and provincial levels, were introduced into the original proposal by one of the communities. In another community the meeting had been very short because the chairman of the co-op had spent the previous two weeks analyzing the proposed program individually with each of the subteams; in the process adjustments were made in the overall plan which

contributed to accelerating the general assembly. There does not appear to be a special preference for either of these approaches to work team participation in planning.

Major operational responsibilities are vested in the *Ri* cooperatives. The ultimate decision-making body is the general assembly of all members. To be a member, a person has to work a minimum number of days during the year, giving him or her the right to participate in the distribution of production (profit sharing); generally these norms are fixed at somewhat over 300 days for men and slightly less than that number for women, including normal vacation time. Work teams are given a fixed area (generally 120 *chongbo*) with animals and machinery. The work teams are comprised of 50 to 100 people, ideally forming an integrated unit with skilled people providing most of the technical knowledge necessary for completing its assigned tasks.

Even after the reorganization of the cooperatives, the problems of waste, inefficiency, low productivity and neglect of equipment were seriously limiting their growth. To improve accountability and to relate the annual distribution not only to the quantity but also to the quality of the work, the work teams were subsequently divided into subteams and even into brigades with responsibility for specific areas, tasks, and/or instruments. In the new "small work-group contract system," approved by the Party in November 1965, smaller units were assigned production targets, which became the basis for evaluating the year's work. These subteams form the basis for the peasant's "economic family" which might include from 15 to 25 people. Over- or underfulfillment of the goals was the basis for premiums and penalties in the final distribution of the co-op's total output. In this way, there would be a clearer identification of individual remuneration with collective work efforts in a way that was not possible when the unit of accountability was, in effect, the whole co-op.

The *Chongsan-ri* approach to management has stood the test of time. It remains basically unaltered from the structure that evolved in the sixties. The national planning agencies, the provincial flow-through, and the county administrative apparatus are still fundamental parts of a structure that places key operational responsibility in the hands of the village cooperative management committee. The small work-group approach to task planning and distribution also proved itself to be an effective means of combining material



incentives with awards based on participation and support for the institutional structure; together they strengthened the collective organization of work.

#### 4. INCENTIVES

Appropriate incentives were needed to assure that the new collective structures and management systems would indeed stimulate increasing individual efforts and accelerate the rate of economic growth. Accountability for production and equipment had to be combined with ways to stimulate innovation. Individual rewards could not, however, come at the expense of further developing the collective consciousness of the workers. Lengthy intra-Party debates about these problems occurred throughout the sixties, leading to a system which combined material incentives with moral-political stimuli.

##### a) Material Incentives

The present distribution system on the cooperative farms attempts to resolve the incentive problem which plagues most socialist societies. It combines material rewards for individual productive activity, with inducements to improve the collective approach to work and political recognition for constructive participation. At the co-op level, physical output is distributed at the end of every crop year, generally in November. After deducting expenses and a reserve for future cooperative investment and socio-cultural programs, the distribution is determined by evaluating each member's work credits and the team's output in comparison with its targets. The credits are a product of the number of days worked and the relative weights assigned to each of the various tasks.

Individual remuneration is based on quantitative indicators of work and collective evaluations of individual performance within the small work-group. In cases of severe disability or illness, the entire community assumes financial responsibility for the worker's family on the basis of previous earnings, while minor, temporary problems are usually dealt with by the individual. Work team and co-op officials also receive bonuses based on the overfulfillment of targets by each of the subteams and the community as a whole. Ninety percent of the distributed portion is paid out directly, while the remaining ten percent goes to the work teams who have over-fulfilled their goals.

Financial incentives are offered to individuals or groups who contribute to reducing production costs in any plan period. This system permits a work group to redistribute unplanned cost savings within the workplace. An increase in profits will be distributed directly to the workers or co-op group members as higher salaries, larger bonuses, or improved fringe benefits. Of course, during the next planning period--generally annual--it will be up to the (politically) most "advanced members" of the production unit to attempt to get acquiescence of the remaining members of the work team to an increase in productivity norms to reflect these unplanned improvements. The discussion of the division of the fruits of technical change between future consumption and investment is particularly important in agriculture where the rate of introduction of new techniques and equipment is relatively high; the Korean authorities attempt to retain a high proportion for investment.

There is an important exception to the wage system which reveals a more general solution to particular problems. Tractor drivers and some other equipment operators are not, in fact, co-op members, but rather workers at the county level tractor stations assigned to operate machinery at the cooperative. Originally, these people were paid a salary by their workplace and their productivity was measured by quantitative norms of machine usage and maintenance. This led to a conflict with the farm work teams because the techniques for machinery operation that might maximize remuneration were often different from those that would contribute to raising agricultural production. The conflict was resolved by relating the machinery operatives' wages to performance of the work team or subteam with which they are associated: 20 percent of the tractor operator's wages are paid by the county while the remaining share is paid directly by the co-op as part of its distribution, with bonuses or penalties depending on the results; the co-op is later charged for that part paid by the tractor station as well as for use of the state-owned equipment.

A somewhat different problem is posed by the mobilization of bureaucrats, soldiers, and some urban workers. Throughout North Korean society many social groups that normally perform intellectual or office work are expected to do manual labor one day a week. At some critical periods of the year--planting and harvesting--large numbers of urbanites also go to the countryside for ten day periods. These mobilizations contribute to alleviating seasonal labor shortages while also reinforcing the principles of individual

political development and urban support for the countryside. These people continue to be paid by their home workplace and bring their basic food supplies with them.

The problem of who should appropriate the benefits of this labor arises because of the difference between property forms in the urban, predominantly socialized sector and the rural, cooperative sector. In this case, the state assesses the cooperative for the value of the labor contributed by these people which goes to partially compensate the state for the wages they actually received; the charge is based on the costs of the tasks actually accomplished rather than the time expended in recognition of the lower productivity of the guest workers.

#### b) Moral-political Incentives

Non-material or moral-political incentives, as they are called in North Korea, are another important form of rewarding people. They are important for several reasons: 1) in a period of rapid development it is convenient to restrict personal incomes and consumption so as to increase investment; 2) in the construction of a socialist economic system and a collective consciousness, special emphasis is usually placed on increasing productivity by appealing to people's political enthusiasm and creativity. Political discussions led by Party members are oriented to increase production targets (the basis on which material incentives are determined) and to find ways to exceed the goals set by the plan.

There exists a debate in development literature about the efficacy of stimulating greater personal exertion and participation by appeal to collective interests and political motivations, rather than, or in addition to, their individual economic interests. (Silverman 1971; Riskin 1975).

In North Korea, the debate about the role of moral-political incentives was prolonged and lively. The Koreans were searching for ways to avoid the mistakes (as they evaluated them) of the primacy accorded to the market by the Eastern European reform movement at the expense of the revolutionary labor movement. (Brus 1968). They "sought a way out of these difficulties through a mass movement to renovate its systems of economic management and planning--in other words, putting politics in command without ignoring economic realities" (Brun and Hersh 1976:321). Guidelines for determining a reasonable balance between material stimuli and moral incentives appear to have

emerged even before the publication of Kim Il-Sung's essay on the subject: "On some theoretical problems of the socialist economy" (March 1, 1969). It became clear that individual efforts depend not simply on their productive contribution but also on the country's development path, the advance of technology, and the revolutionary enthusiasm and creative initiative of the masses. The essay identified the last element as the most decisive: "The essential excellence of the socialist system lies in the fact that the working people freed from exploitation and oppression, work with conscious enthusiasm and create initiative for the country and the people, for society and the collective, as well as for their own welfare."

The Chollima (Flying Horse) Rider Movement, initiated in 1961, was an early example of this approach to labor mobilization. Its aim was to stimulate workers to set new production records through emulation. This particular movement emphasized technological, administrative, or other innovations designed to increase productivity. Honored workers or work teams have their machines or work areas decorated, while co-ops that make outstanding contributions are often personally honored by Kim Il-Sung with great fanfare in the media. The Flying Horse recognition has been complemented by other awards for plan over-fulfillment and other criteria of excellence, such as the medal of the Kim Il-Sung Order, Labor Hero of the Republic, and of Merit. A more common insignia, the 26 Work Medal, is awarded to work teams that consistently meet and then increase their assigned goals. There has been a regular progression of special campaigns to stimulate production, among the most noteworthy are: "Pyongyang speed"; "Carrying one more load movement"; "Watching the early star movement"; and "Speed of the eighties." In most cases the political recognition was accompanied by some pecuniary reward, that might include a monetary payment or a special vacation benefit for the workteam.

Kim Il-Sung also participates directly in the effort to implement moral-political stimuli. He often visits outstanding co-operatives and industries to learn about their achievements and to "give instruction" on how existing procedures might be improved. Similarly, he will visit problem work teams or communities to make suggestions about how to overcome difficulties. These visits are all commemorated by plaques which are prominently displayed to reflect the honor bestowed on the group by the visit. These visits appear to be spontaneously recalled by rural workers as a source of inspiration

for further efforts or to correct attitudes and procedures which might be a "carryover of capitalist mentality."

The Koreans emphasize the importance of combining both forms of incentives. Material incentives are needed because people still have an "obsolete mentality" based on holdovers from the previous society, thought patterns which cannot be simply erased by the political desires and commands. This approach requires distribution based on the socialist principle of "to each according to his work" which militates against an egalitarian system. Distribution, therefore, corresponds to the skill and quantity of labor. This approach partially contributes to raise the collective consciousness of the workers since individual labor is part of a team effort and the people work together to increase productivity. The collective organization of work, however, must also serve to advance the attainment of social objectives. For this reason moral-political stimuli are an important part of the mechanism for labor management in Korea today.

#### c) Living Standards and Money Incomes

The relationship between living standards and money incomes is another issue of primary importance in understanding and evaluating the incentive system. The prevailing wage and bonus system is designed to differentiate salaries in accordance with skills and labor input as well as level of responsibility. The Koreans decided that productivity increases must not be the basis for a permanent rise in wages because most are the result of state investment in technological development, training, materials, and machines. Innovations, likewise, are not rewarded with higher wages, but generally with a single monetary bonus and a political award. Production targets are regularly adjusted to reflect constant labor requirements rather than productivity so as not to penalize workers in the most physically demanding industries or those with the oldest machinery.

The resulting income differences are not an accurate reflection of differences in real living standards. Since a significant part of the value of consumption is provided through direct distribution, money incomes are not the primary determinant of the quantity of goods and services available to each household. In addition to the panoply of services normally distributed to people in socialist societies at little or no charge--medical care, education, urban services, etc.--the range of other goods the Koreans

provide is quite important. Housing is the most significant of these, with no charge for rental or ownership; and strenuous efforts are being made to provide everyone with adequate shelter. Every worker has the right to a two week all-expense-paid vacation with his or her family. Basic consumer goods are also provided at highly subsidized prices to everyone in the society; the most significant of these is the price of basic food grains and some other goods distributed through the state supply system (see below).

Thus, the base level of real living standards is not determined by cash incomes but by state policy about the basket of goods and services which are made available to all households, regardless of occupation or income. Money incomes are important to determine discretionary purchases of extra clothing of a higher quality than that distributed in workcenters and schools, and the availability of some consumer durables (washing machines, vacuum cleaners, refrigerators) which are not widely distributed. The material incentive system works only to improve the margin of expenditures for these items, which include many foods as well as other types of goods.

## 5. INTERSECTORAL RELATIONS

The changes in agricultural organization and management were part of a general restructuring of the Korean economy. When the Japanese were forced off the peninsula, the society was predominantly rural: in 1946 three-quarters of the labor force and two-thirds of the gross output were in agriculture. After the massive destruction of the Korean War, the government placed primary emphasis on heavy industrialization. Agriculture was expected to provide an important part of the resources needed for industrialization by 1) assuring a supply of cheap food, 2) producing industrial raw materials, 3) generating foreign exchange earnings (or reducing foreign expenditures), and 4) releasing a regular supply of labor to the urban areas.

North Korea, unlike many other socialist countries, has not systematically discriminated against agriculture. Diverse sources report that government investment and price policies quickly became supportive of agricultural development, once the initial reconstruction efforts had been successfully completed. Even in the late 1950s government investment in

agriculture represented about 11 percent of the total, with resources going principally into reconstructing and extending the irrigation system for rice cultivation. This quickly rose in the five years following collectivization (1959-1963) to an average of 21.7 percent of total construction investment (Scalapino and Lee 1972:1097). A great deal of (unquantifiable) additional investment was realized by voluntary labor mobilized under the system of moral-political incentives for land reclamation, irrigation, and the building and repairing of pumping stations and reservoirs.

With the completion of the process of collectivization, the state assumed financial responsibility for building the technological and material foundations for future growth in the rural areas. In the 1964-1981 period direct state investment in basic rural construction projects (this includes only physical investments, rather than research and development, education, training, etc.) amounted to 19.7 percent of its total budget (DPRK 1983:21). Effective support was in fact much larger, because this figure does not include investment in industrial projects to directly support agriculture, such as those related to tractors and other farm machinery, fertilizers and agrochemicals, irrigation equipment, etc. It also does not include a value for the substantial labor input in rural public works during this period.

The commitment to self-reliance emphasized the significance of agriculture as a key building block in the process of achieving self-sufficiency. The new relationship between industry and agriculture was based on the need for industry to aid agriculture in its modernization process. Because of the heritage of individual land ownership and the tradition of cooperation in small groups rather than in large cooperatives, which restrained the advance of collective consciousness among peasants, particular emphasis was placed on "working class leadership of the peasantry"; that is, of the role of urban workers and cadres providing examples of voluntary cooperation in fulfilling the rural production and investment programs.

The relative roles of agriculture and industry in national development were constantly reevaluated. After the initial insistence on industrialization (1953-59) produced an internal crisis of falling living standards, increased recognition was accorded to the importance of light industry and agriculture to supply the consumer goods necessary for improved material

welfare. The large-scale heavy industrialization was rapidly complemented by the emergence, after 1957, of a vigorous cooperative industrial movement throughout the country, dependent on local resources and labor, with virtually no state investment. These industries were expected to draw on underutilized labor in an already tight labor market: housewives, the aged, and children. Agricultural cooperatives were particularly active in this movement to diversify production, increase incomes, and broaden the range of goods available for local consumption.

Agricultural development rapidly became limited by the lack of technology and equipment. State investments and industrial production were modified to accelerate the flow of equipment and technology to the rural areas to accelerate the rate of growth of productivity which was to become the driving force behind rural development. Four areas of technical advance (to be analyzed below) were identified as priority along with designing industrial production for agricultural needs; in this way tractors and farm implements became increasingly available as irrigation and electrification plans were completed and agrochemicals were introduced.

These modifications altered rural-urban economic relations dramatically in the 1960s. The tax-in-kind was abolished by 1966 and the producer prices for grains were maintained high even while consumer prices were lowered (at the present time the price per kilogram of rice is 0.60 won while it is sold to the consumer at 0.08). This represents a substantial subsidy for rice and other basic consumer goods which directly benefits the co-ops. At the same time, the state assumed responsibility for the construction of the irrigation system and other rural infrastructure, cancelling accumulated debts. It changed the payment system for machinery to effectively lower the burden for its use on the farms. Likewise, prices for fertilizers and other producer inputs were lowered, significantly reducing the cost of agricultural production.

Other changes were introduced to increase state provision for other basic services. Schools were extended to every community and now effectively encompass 11 years of obligatory attendance. Cultural facilities, including libraries, film and music programs, gymnastics and other physical culture programs, etc., were also broadly disseminated in the rural areas. Similarly, the medical care system was broadened to assure national coverage. Finally, the state undertook a massive housing program to assure



everyone in the country an adequate dwelling space; during the period up to 1981 more than 957,000 units were constructed in the rural areas and distributed without cost to replace those destroyed during the war and to reconfigure rural communities in accordance with the new administrative and production schemes.

Another important reinforcement of the co-ops came from the labor mobilization programs. Urban workers and the army are regularly used to assist the co-ops in fulfilling their production quotas and advancing their investment projects. In the first decades after the war, these labor mobilizations were of extreme importance in assuring the completion of seeding and harvesting tasks within the planned time frame. During the slack periods of the year these workers were used to help extend the irrigation system, build new reservoirs, or contribute to various other rural construction schemes. This type of occasional labor was also used to expand the productive apparatus by building new rural industries and other installations. As mechanization of seeding and harvesting has been extended, less volunteer labor has been needed.

These qualitative remarks about relationships between rural and urban areas do not permit any evaluation of the net contribution of agriculture to capital formation. It is clear, however, that since 1955 agriculture's position in the Korean economy has changed dramatically and is quite different from that of other socialist countries.

North Korea has been able to maintain the rate of growth of agriculture at high levels. The net contributions which the rural areas were forced to pay to the urban have now been substantially reduced. But without more information on the structure of prices and costs in the DPRK, it is impossible to determine whether or not the sector is a net contributor to social savings.

What does seem clear, however, is that the improvements in agricultural productivity and living standards of the rural labor force have been quite substantial. They reflect an acceptable level of stimulation for the cooperative members, and a satisfactory intersectoral (industry-agriculture, urban-rural) relationship that assures the country its food supplies at a reasonable cost.

## 6. A QUALITATIVE APPRECIATION OF AGRICULTURE

Quantitative data from the DPRK are scarce at best. In official speeches and documents there are often references to proportional changes in production and/or the structure of the economy. There is no way to verify estimates made by international organizations or foreign scholars other than direct observation or informal discussion with local experts. In spite of these tremendous lacunae, there is a remarkable consensus about the current state of North Korean agriculture: it appears to be relatively well organized to continue to improve on its past record of growth and diversification.

### a) The Changing Role of Agriculture in the Economy

When the DPRK was formed in 1945, the country was predominantly agricultural. Almost three-quarters of the labor force (74.1 percent) were peasants and 63.5 percent of national income was reported to have originated on the farms. During the following four decades farm production increased dramatically and the country is now better able to feed itself and produce raw materials for industrial production. But because growth in other sectors has been even more rapid, the share of farm production in national output and the labor force declined markedly (Table 1).

### b) Global Indices of Agricultural Production

The Food and Agriculture Organization (FAO) has produced a regular statistical series on North Korean agriculture for several decades and its output indices which it publishes are revealing of overall tendencies. These data are not simply a transcription of official data, but rather estimates based on expert evaluation of the evolution of the prevailing situation. As will be evident below, these numbers differ substantially from government sources, almost always falling below the official reports. For this reason, and because no other general index of agricultural production is available, they form the basis for the analysis presented here.

There have been marked differences in the rate of growth of agricultural production since the Korean War. According to the most authoritative estimates available (summarized in Chung 1974), agricultural output increased substantially in the first decade as a result of the crash efforts to speed reconstruction. There was a substantial decline in growth rates in the 1960s because of the lack of technical progress, organizational inefficiencies, and ineffective

incentive systems; these were particularly severe in agriculture. The two most recent plans (1971-1976 and 1977-1984) have apparently been implemented with far fewer problems with output targets that appear to have proved quite attainable.

In other areas not covered by these indicies, the North Koreans report high growth rates. In the 1960-1980 period they achieved substantial improvements in fruit and vegetable output (9 percent and 5 percent annual growth respectively). New industrialized methods for egg, poultry, and hog production also made a significant contribution to the availability of food; during the 1949-1980 period output of meat increased 9 percent annually, while egg production rose about 16 percent a year (DPRK 1983:19).

### c) Grain Production

North Korea has placed special importance on increasing the land under cultivation and the productivity in cereal producing areas to supply domestic food needs while diversifying production in other regions. The government initiated a broad range of technological and scientific activities to increase yields and improve soil fertility (see below). They have also made a decision to export relatively small volumes of rice and import larger quantities of (less expensive) wheat as a way of assuring adequate grain supplies and generating foreign exchange earnings. The FAO data report a steady progression of production and yields (Table 3).

There are important discrepancies between FAO data and official DPRK sources. The most significant differences are in the yields, which the Koreans claim reached a national average of 7.2 tons/hectares for rice and 6.3 for maize in 1980 (Table 4). Although some ascribe the difference to the fact that the Koreans calculate rice yields by the husk (which might represent as much as 30 percent of the total), the FAO figures are also for paddy rather than milled rice. It is striking that even using the lower FAO figures, in 1983, the reported yields are the highest of any nation in the world in rice and among the top ten in maize (behind certain European countries and Israel).

The North Koreans report harvests of 8.5 million tons of grain in 1977, nine million in 1980, and ten million in 1984. They anticipate a further increase to 15 million by the end of the decade. To achieve this next objective they plan to obtain additional yield and production increases by extending current production techniques to all grain areas, accelerating the

introduction of machinery and agro-chemicals, and reclaiming tidelands for intensive cultivation. They contemplate average rice yields of eight to ten tons per hectare and only slightly lower maize yields.

#### d) Foreign Trade in Agricultural Products

Another cornerstone of North Korean agricultural development policy is overall self-sufficiency. As the Koreans explain it, this means having the capability of producing all the foodstuffs required to provide an adequate diet to all the people. This does not, however, exclude the possibility that when it is advantageous, some domestic products will be traded for foreign goods, based on the principles of comparative advantage. The DPRK has been a regular exporter of rice, apples, and vegetables, which it exchanges for wheat and wheat products.

#### e) The Present Structure of Agricultural Output

In the mid 1950s, according to the FAO, North Korea had a total land area of about 12 million hectares. Currently, 2.2 million are considered arable and half of these are presently under irrigation. An additional 90,000 are sown with permanent crops and 50,000 are permanent pastures. The population is about 18.5 million, and growing at about 1.6 percent annually. This means that there is about one-tenth of an hectare per person available for annual crops at the present time, a relatively small endowment. The Koreans report that in addition to the annual crops, about 300,000 hectares are planted with fruits on state and co-op farms.

The cultivated area in 1983 was principally occupied by grains (78 percent). Other significant uses for land are pulses, roots, and tubers (Table 6). Based on present (Korean) estimates of about 1.8 million hectares actually under cultivation, the land use data confirms the impression of extensive double, and even triple cropping.

Non-agricultural food production has become a growing source of nutrients and diet diversity in North Korea. Emphasis was placed on industrialized poultry (chicken and duck) and hog raising and now each province has at least one very large egg producing facility. This has involved not only bird and animal reproduction, but also adequate personnel, industrial equipment and machinery.

In summary, it appears that agricultural output growth for food and for industrial raw materials (principally cotton and silk) has been quite dynamic since 1970. Per capita food availability has increased steadily and been complemented by the burgeoning production of non-vegetable sources of protein (eggs, chicken, pork, and fish). As a result, there has been a significant increase in consumption standards (discussed below), both in quantitative and qualitative terms.

## 7. THE "THREE REVOLUTIONS"

From the very beginning of the post-war period, the North Koreans have recognized the need for a multi-faceted approach to restructuring agriculture. A technological revolution was required to create the new techniques and equipment necessary to permit a more intensive cultivation of the limited arable land. But the technical innovations would have to be implemented within a new institutional and ideological structure which would, according to the Koreans, liberate the human energies necessary to ensure a rapid advance of production in the future. This thought was canonized in Kim Il-Sung's essay "Theses on Rural Socialism in our country" (Selected Works, Vol 2, 1964) as the Three Revolutions: ideological, technical, and cultural.

### a) The "Ideological Revolution"

The primacy of the ideological development of the individual within the evolution of the new society is a fundamental tenet of North Korean social and economic doctrine. The focus is on the transformation of the peasants' ideological consciousness, instilling in them a spirit of collective awareness and responsibility for the evolution of the rural economy. This was carried out by a lengthy series of educational campaigns among the peasants which focused on the dual concepts of self-reliance (*Juche*) and individual sovereignty (*Chajusong*). The first was a collective task to be realized by individual contributions to a national productive and technological effort while the second started from the basis of the individual charged with acknowledging his or her potential as a result of an intense interaction with the collectivity.

This focus on the political development of the individual and the forging of a collective consciousness appears to have played a key role in the political integration of the Ri cooperative and its members into the national development program. It was particularly important in the first decades after the war because of the severe shortage of human, technical, and mechanical means to implement the other transformations contemplated in the rural theses. As a result of the effective use of this process of political education, the special mobilizations to stimulate extra productivity appear to have been effective, when combined with the revised system of material remuneration, in forging a perceived commonality of interests between the individual peasant, the cooperative, and the nation.

#### **b) The "Technical Revolution"**

To a Western observer, the technical revolution is the easiest to understand; it is also the best documented of the three. The Koreans defined irrigation, mechanization, electrification, and use of agrochemicals as the fundamental tasks of the technical revolution in the countryside. In each of these areas notable advances are widely acknowledged to have contributed to increasing land productivity and freeing up labor for tasks in other parts of the society.

Irrigation was accorded highest priority from the beginning of socialist construction. In 1945, the country had less than 100,000 hectares under irrigation, while its rice fields were dependent on rainfall for their development. At the beginning of the eighties, the country reports that all of its rice fields are under systematic irrigation or controlled drainage as are most of the other lands used for crops that need it. About 1.2 million hectares were under irrigation in 1981, representing about three-quarters of all lands cultivated with short-cycle crops. These irrigated lands are serviced by 1,500 reservoirs and 23,700 pumping stations along a network of 40,000 kilometers of clay-lined canals. The drainage system consists of 1,340 pumping stations and almost 1,500 kilometers of canals (DPRK 1983:44-55).

Electrification of the countryside was completed by the end of the 1970s. This achievement meant that agricultural processing could be uniformly switched over to mechanical means nationally. It also meant that every family could begin to aspire to the slowly increasing range of consumer durables that were becoming available. The rate of advance on this score is quite high. In 1960, about 62 percent of the

households in rural North Korea had their own electricity service; by 1967 this figure had risen to 80 percent, while the task was finished in 1980 (DPRK 1983:60-1). In 1985, use in rural areas was about 33,000 million KWH; about one-half of this is generated from hydroelectrical plants, while the rest are fueled by coal.

Mechanization continues to be a priority in the countryside. By the early 1980s the state had supplied to the cooperatives an average of seven tractors (15 horsepower equivalent) for every 100 hectares in the flat areas and six in the higher and hillier parts of the country (DPRK 1983:67-9). It set a goal of supplying additional tractors to agriculture during the 1980s to reach a level of 10 and 12 tractors per 100 hectares respectively. This is considered a stable equilibrium level already achieved on the state farms, a base from which qualitative improvements can be introduced in the future. Some important work is being undertaken to reshape the fields themselves by terracing and other leveling operations and by enlarging plots in many parts of the country to facilitate the use of larger and more efficient machines.

In addition to the tractive power itself, a whole range of farm implements and equipment have been designed and introduced to meet the specific needs of the Korean countryside. These include implements for seeding, transplanting seedlings, plowing, spreading fertilizers, cultivating, and harvesting. They are evident as one travels about the country. An average of 1.5 trucks per 100 hectares is available on the cooperatives for all transport needs. The Koreans report that with the present levels of mechanization it is now possible for a single person to be responsible for 2.5 hectares of rice cultivation, about four hectares of maize, or ten of other crops. The near-term goal is to raise this level to five hectares each for rice and maize (DPRK 1983).

The application of chemicals to agriculture is the fourth important aspect of the technical revolution. The primary thrust in this area has been the introduction and expansion of the use of the appropriate combination of inorganic elements to fertilize the soil. Working under the banner of "Fertilizers are rice, rice is socialism" special efforts were made to intensify the production of this vital input and ensure its correct application in the countryside. Starting from a very low base of

fertilizer use of 131 kilograms/hectare of gross fertilizer weight as a national average in 1949, the figure rose to almost two tons by 1984 (Table 7).

In discussing fertilizer use with Koreans, it became clear that these figures do not reveal a complete picture. Several problems were raised relating to the effective nutrient content of these inputs and the way in which they are used. Reserving some of the analysis for the next section, here it should be pointed out that a substantial volume of organic fertilizer is used from animal and farm wastes as well as from systematic use of night soil. Although I was given a figure of 20 tons per hectare, this figure seems less meaningful and accurate than the fact that the beds from which seedlings are transplanted are constructed almost entirely from a humus mixture rich in green manures carefully composted before application.

Another knowledgeable person commented in a lengthy discussion of problems of agricultural productivity in Korea that there was a growing awareness of the possibility that too heavy a dose of chemical (inorganic) fertilizers was being applied in some areas, the result of the overzealous application of national norms on a local level, which was actually leading to a decline in productivity. New techniques were being tested to examine the appropriate mixture of nutrients in accordance with recent improvements in understanding of the role of fertilizers in plant growth. This person added, however, that greater emphasis on non-industrial fertilizers would require substantial educational efforts among the peasants who had become convinced of the productive bounty of the inorganic material.

Pesticides are an increasing part of the agrochemical industry. Once again, referring traditional techniques and local technology and materials, the Koreans emphasize the national character of this segment of the chemical industry. They point to the wide variety of specialized substances which they are producing for the specific conditions of their agriculture. A growing part of this effort is apparently oriented towards the reinforcing of modern forms of biological control over different types of pests and weeds. While some of these involve the production of new agricultural inputs (e.g., large-scale production of larvae to control some pests), many involve the dissemination of new cultivation techniques which involve reducing the use of industrial pesticides. (see next section).



### c) The "Cultural Revolution"

The cultural revolution involves the reconstruction of the peasants' physical and institutional environment. Emphasis was first placed on education, eliminating the heritage of illiteracy and then increasing the basic skills and technical capabilities of the rural population. To do this, access to the basic educational infrastructure was extended to all parts of the country, beginning with primary education, and then expanding to secondary and technical schools, as well as child-care centers and pre-school facilities.

Special attention was paid to adult education. With the reorganization of rural communities into cooperatives, a more receptive environment existed for establishing technical training courses once the basic task of adult literacy had been achieved. Throughout the country courses were established to provide programs that offered the participants secondary school equivalency while better preparing them technically for the specific tasks that might be required in their communities. This program has now been extended to a broad program of on-the-job education through correspondence courses and self-study programs in which a substantial proportion of the population seems involved.

Higher education has also been made available widely. Each of the nine provinces has its own university, including an agricultural college, a medical faculty, a teacher training institute, among others. With the recent stress on specialized training substantial numbers of people are reported to be taking these courses and on average, in 1981, each cooperative farm had 57 technicians and specialists charged with the diverse mechanical, biological, agronomic, and other tasks needed to control and raise production. Local training courses are complemented by a broad involvement of the community through the specialists, the cooperative managers, and the schools in analyzing and understanding the productive tasks and problems it confronts (DPRK 1983:132-40).

## 8. THE ROLE OF SCIENCE AND TECHNOLOGY

The North Koreans place great importance on the development of science and technology. In all discussions of rural development they stress the complementarity between the advance of knowledge about production and the political and material investment discussed in the previous sections. There appears to be no literature available in the West on this subject; the brief comments offered here are based on visits to several agricultural cooperatives as well as on discussions with the Dean of the faculty of agriculture at the National Economics University and with agricultural economists at the National Agricultural University, both in Pyongyang.

The most striking thing about observing grain cooperatives in North Korea is the intensity and diversity of cultivation. In travelling around the southeastern part of the country, small, carefully terraced, rice and maize fields were ubiquitous; other crops were used to demark field limits and were sown along the slopes separating levels. Plant densities were extraordinarily high when compared to Western methods and virtually all crops were transplanted from seed beds where they were initially sown, generally in humus molded in the form of an organic pot. The variety of species and their contrasting heights was also noteworthy, explained as reflecting an attempt to maximize exposure to direct sunlight and to take advantage of biological complementarities.

Although my visit was in July, it was also evident that a substantial investment had been made to prolong the agricultural year. Greenhouses were evident in the vegetable growing areas and irrigation systems were designed to reflect the needs for water of differing temperatures at different times of the year and different points in plant growing cycles. Early planting of rice and maize seeds in controlled nursery conditions, with plastic sheeting and water temperature control, were used to start the growing process earlier than had been the practice.

Children participate in an information gathering network about agricultural conditions. Primary students are responsible for monitoring the temperature of irrigation water in all reservoirs in the country. Secondary school youngsters systematically take soil samples from local lands and test them to determine quality and assist in establishing appropriate land management measures and fertilizer dosage. In short conversations with some of the students it was clear that they were learning a great deal about the reasons

as well as the mechanics of fulfilling their tasks. Their responses included comments about the operation of the hydraulic systems, the importance of using water of differing temperatures for varying purposes, and the need to constantly monitor soil quality.

There has been a great deal of research for the development of new plant varieties. Virtually all species for which hybridization is practicable are sown with these high yielding varieties. There appears to have been an active interchange between North Korean scientists and their counterparts at the International Agricultural Research Centers, especially CIMMYT in Mexico (maize and wheat) and IRRI in the Philippines (rice). The North Koreans say that they prefer to use their own varieties, rather than those derived from samples obtained from these germplasm banks because their experience in terms of productivity and resistance to local conditions is better. My impression is that they have developed new varieties based on a combination of local varieties and germplasm coming from international sources, especially in the case of maize; this is confirmed by international trade data which documents shipments of sizable quantities of expensive maize to the DPRK from several European producers of seed-quality maize throughout the seventies.

There appears to be important work proceeding in the area of biological controls. The scientists explained that they are directly concerned about problems of environmental contamination from the use of pesticides and were researching different forms of natural control of pests. They were aware of important developments by their predecessors as well as a growing interest in the West on this subject. They had already succeeded in modifying planting patterns to take advantage of crop complementarity which would help reduce the damage occasioned by pests. They are also producing sterile varieties of some insects which reduce their propagation rates during certain crucial periods of the year.

Land management was another important area of research and technical advance. The agricultural experts continually expressed concern about the dual problem of the dearth of arable land and poor soil quality. Substantial work was in process on problems of improving fertility with long-term approaches to complement the cyclical fertilization now used. To this end, many co-ops were involved in extensive land moving projects to raise average soil quality by mixing soils from different parts of the farm. Additionally, important efforts were directed to reclaiming un- and

underutilized land by terracing, more systematic leveling and recontouring of cultivated lands to increase the total area which might be sown under optimum conditions.

Reclamation of tidal lands is the most ambitious of these land management projects. The North Koreans have embarked on a massive earth moving program to reclaim 300,000 hectares of arable land at sea level with an extensive dike and canal system. They propose to terminate this project by the end of the 1980s as the substantial lockgate they have constructed at Nampo begins to fill the nearby river system with sufficient water to drive out the saltwater from the affected areas. This project is combined with another ambitious project to tunnel through 20 kilometers of mountain to build a navigable waterway which will connect their east and west coasts, offering many advantages in terms of transport costs and water management. When completed, this project will increase the total arable area by about 15 percent, and the paddy fields by about 35 percent, offering a definitive solution, according to the North Koreans, to their domestic food supply problems. Some people also speak of the likelihood that once the engineering and other technical aspects of this project are more carefully examined and improved, it should be possible to reclaim somewhere between 500,000 and one million additional hectares from the gently sloping continental undersea slopes off the eastern coast.

The North Koreans refer to these projects as the remaking of nature. This illustrates another striking characteristic of their attitude towards planning change on a national scale. They express the opinion that people have great latitude to reshape the country's natural environment. This takes many forms, including substantial conservation efforts which are also undertaken in other countries. Reforestation of northern areas and war devastated parts of the country proceeded at a rapid pace. Water control and conservation efforts appear to have substantially reduced problems of erosion and improved quality levels throughout the country. The *Juche* philosophy of self-reliance and its stress on people's independence (*Chajusong*) clearly express this characteristic of the dominance of people over nature, but in examining the way in which this is being worked out in the DPRK, the apparent regard for the needs of the environment is striking.

The possibilities of further improvements in food production through higher land productivity seem to be limited. Some advances are expected from extending mechanization. There is a recognition of the limited usefulness of additional doses of fertilizer in increasing production. This is widely acknowledged and is part of the reason for present land reclamation efforts. Biological control and composting are two approaches to the problems of soil fertility and agrochemical degradation of the environment. Discussions about these subjects and the future of agriculture in general revealed concern about the abuse of technology and the potential for learning more about environmental systems which will contribute to maintaining and increasing production in the future. They also help to explain the country's very high levels of land productivity.

## 9. CONSUMPTION LEVELS

Although there are virtually no data on consumption standards in the DPRK, there is general agreement in the literature that the average diet more than adequately meets minimum international nutritional norms (e.g., Pak 1983:228). The FAO has constructed indices of food supply which provide some indication of improvements in the nutritional quality of the diet (Table 8).

Some additional remarks about consumption levels are possible, based on interviews with numerous respondents chosen at random in the capital city and on cooperative farms. Many basic foods are distributed through a "supply system", which the North Koreans differentiate from a rationing system because, they argue, it is not based on scarcity. They feel that the present system is a great advance from the extreme levels of austerity to which they were subjected for quite some time after the Korean War. It provides a firm basis for moving forward towards a communistic distribution system (based on needs rather than ability to pay or administrative fiat). Although they point out that they are not yet at the point of "administering prosperity", because production and consumption are too closely balanced, the supply system is still being developed to permit a transition to a higher form of social relations founded on an abundant supply of basic foodstuffs.

At the present time the supply system does not provide everyone with an equal quantity of all distributed goods. Workers in privileged positions and those who exert more energy are entitled to larger amounts than others. Children receive special additional foods through the school system. Elderly people also have their supplies specially tailored to their conditions. The numbers provided must be taken as general indications of consumption levels rather than fixed quantities; it was very difficult to get a precise description and quantification of the system, and different informants provided me with slight variations around a fairly common level for most commodities.

A final point about prices. In general, the cost of obtaining these foods is quite nominal, reflecting important subsidies, especially as noted for grains. When asking people about the cost of food, it was necessary to change the point of departure in phrasing the question from asking about its high cost but rather to focusing on its low cost. People in general do not appear to be constrained in their daily living standards by the cost of the foods which they purchase within the supply system. Information about the peasant (non-state) markets is too limited to speculate on the impact on consumption of the generally higher prices prevailing there. One comment is in order, however, about consumption standards when compared to another society with which I am familiar. There does not seem to be any great pressure to complement inadequate food availability through the supply system with restaurant meals, as was the case in Cuba during some periods of shortages.

Grains are the most important goods administered through the supply system. On average every person in the country is entitled to about 600 grams of a mixture of rice and maize in the ratio of 7:3 (420 grams:180 grams); it is not clear to me how barley and wheat are included in this distribution, but it seems that different grains are substituted according to availability. The variations in the allocation are from about 400 grams for children in some areas to 900 grams for some particularly demanding occupations (mining, iron foundry workers, etc.). Children also receive vitamin enriched bread and milk daily through the schools. Meat of all kinds is rationed, but chicken and pork are generally available at higher prices on the peasant markets. My impression is that an average of 6 kilograms per month is the personal allocation. About 20 eggs per person per month are distributed through the controlled market, and virtually unlimited supplies are obtainable on the open

market. Perhaps the most striking element of the system is the liberal quantity of fish -- 500 grams a day -- available to every person in the country; obviously this is not fully consumed.

Other goods are distributed on a seasonal basis through the supply system and the peasant markets. Vegetables have increased dramatically in availability during the past fifteen years as have certain temperate-climate fruits. Some of these are distributed directly while a large part are sold through various state channels. On several occasions people in both rural and urban areas commented on their availability in even the winter months, a dramatic change from colonial days. In general, the impression of the food system is that people are well nourished and are enjoying an increasing variety of foods as the multiple cropping systems during the lengthening growing year permit an important easing of previous restrictions in personal consumption.

#### 10. WHAT CAN WE LEARN FROM THE KOREAN EXPERIENCE?

This analysis of the development of agriculture in North Korea since the end of the war is necessarily incomplete. The data is fragmentary and it does not examine the broader context within which this development took place. In spite of these gaps, it seems useful to present what can be gleaned from the North Korean experience to an international audience interested in rural development. This country is not the only one that experienced high rates of growth of agricultural output during the period; its arch rival, South Korea, enjoyed even higher rates of increase of output. What distinguishes the DPRK from other countries in the Third World, is that the transformation of agriculture has not come at the expense of the peasantry or at the sacrifice of food self-sufficiency. These two characteristics sharply differentiate it from many other countries.

There are several important policy measures in the North Korean experience that are noteworthy. Several are consistent with the package of measures traditionally recommended by Westerners to promote agricultural development, while others conflict with this approach. The most obvious of the familiar policies is the apparently large subsidy for basic grain production; consumer prices are less than 15 percent of the producer prices while state charges for

production do not appear to reverse this balance by unduly taxing the cooperatives. The data do not permit us to determine who is really being subsidized, but the net impact is to stimulate production and reduce the cost of consumption.

Material and technical support for agriculture is also relatively abundant and increasing. High quality seeds, fertilizers, and agrochemicals are widely available and can be applied by a full range of farm machinery and equipment. Although the North Koreans are in the process of increasing their stock of equipment, present levels are far superior to those prevailing in most of the Third World. The technical expertise to ensure the correct application of these supplies and the proper maintenance of the equipment also appears to be available. Formal training programs are in place to raise the level of co-op members and a substantial number of young people are being prepared to advance this process.

Scientific research and technical development are systematically oriented to respond to socially determined priorities. The North Koreans do not suffer from a divergence between social needs and effective demand which often creates a conflict in other countries' research and development programs. They have invested heavily in improving agricultural productivity for crops which are needed for national consumption and industrial production plans. As part of these plans, they trade some (high-priced) rice for (cheaper) wheat products with both capitalist and socialist countries. Other agricultural products and derivatives that are exported include fruits, vegetables, and silk. These decisions appear to reflect a careful evaluation of the country's dynamic comparative advantage in international trade; this has been itself strongly influenced by research and production policies which make the DPRK the most productive rice producer per hectare in the world.

These achievements are particularly noteworthy because they have been realized within the framework of a policy of self-reliance. That is, the North Koreans have placed great emphasis on producing the equipment and developing the scientific capacity necessary to realize this agricultural transformation. Clearly, they have learned from others, exchanged experiences, equipment, and personnel. But unlike other countries, these lessons have not been uncritically copied; they appear to have been critically evaluated and adapted to local conditions when found useful. Perhaps the most impressive of these adaptations involves the development of a productive structure which uses



relatively little petroleum as a source of energy or industrial raw material. The North Koreans have gone to great lengths to substitute other sources of energy when possible and develop alternative technologies based on their own mineral endowments.

On the consumption front, too, the North Koreans appear to have adopted a policy approach like that recommended by Western development practitioners. But unlike the results in most other countries, here they have been able to ensure everyone an adequate diet and access to a basic package of other goods and services which satisfies the minimum socially defined norms of adequacy. In fact, from a comparative perspective, nutritional and housing standards are quite high, as is the quality of social services such as education and health care.

It is on the organizational plane that the model appears quite unorthodox. The extreme hardship occasioned by the 1950-1953 war and the heritage of Japanese colonialism facilitated the leadership decision to move rapidly towards full collectivization. The internal processes of debate and decision-making were effective in forging an elite consensus leading to an organizational scheme which stimulated cooperative work processes reinforcing the formal structures. Material incentives complement political rewards to stimulate individual productive efforts without endangering the integrity of the small workteam or the unity of the village cooperatives. The planning process also appears to permit sufficient participation and feedback from the base to produce achievable goals.

The North Koreans have gone to great lengths to ensure that their productive structure corresponds closely to the local pattern of demand and that the resource and technological requirements of this production are in accord with the country's endowments and capabilities. Thus, from a strict instrumental point of view, they appear to have implemented a development strategy like that recommended by Western development experts, but rarely applied in market economies in the Third World. The inputs and the outputs are similar to textbook prescriptions -- it is the process of transformation itself which appears radically different.

An important lesson to be learned from the DPRK's experience is that food self-sufficiency is probably attainable by many other countries. It started out with a meager agricultural resource base and virtually no infrastructure. The initial levels of productivity and knowledge about agricultural problems were also

inadequate. The North Koreans set out to develop a program of material and technical progress based on the principle of self-reliance which would permit them to achieve their production goals in a relatively short time. In doing so, however, the North Koreans stress that the technocratic aspects of their experience are secondary to the political and organizational aspects of the transformation.

Collectivization was only one part of the transformation of the role of people in society. Great responsibility was placed on people to reshape their environment, materially, socially, and perhaps in other dimensions as well. People had to be encouraged to participate creatively and productively in the development process; substantial growth cannot come from an inflexible hierarchical system in which all knowledge and commands flow only from the top. But the collective system's goals will be threatened if people work simply in their own material interest; collective responsibilities and rewards for work must be built into the system if social needs are to be equated with actual production. This appears to be the key to understanding the progress that the North Koreans have made up until now in agriculture. By emphasizing the importance of self-reliance and creating organizational forms in which enlightened self-interest is complementary to collective advance, they have forged an agricultural economy capable of strengthening the country's ability to be self-sufficient.

Many economists question whether such a system can allocate resources efficiently. They point out that great sacrifices have been made to substitute other resources for petroleum, or to convert unfertile lands into grain fields. Surely the country would be better off, the advocates of world-wide efficiency might argue, if it concentrated on exploiting its mineral wealth and trading it for products which cost relatively more to produce locally. This argument would be correct only if one accepted the system of world prices which has created the prevailing international and national patterns of inequality.

Once one modifies the priorities of the market system, and the goals of full employment and guaranteed minimum living standards are placed at the head of the list, the allocation problems become very different. In this setting, the goals become how to find productive employment for everyone, how to motivate people to raise productive capacity, and how to avoid patterns of individual or collective consumption which might threaten social progress. The normal standards of evaluation change because social priorities and

therefore the price system itself is altered -- the social opportunity cost of labor and many other resources is drastically reduced. The task of economic development is not simply to question whether people and resources can be profitably employed. Rather, an effective strategy must assume the task of reorganizing institutions and resource use to offer everyone a constructive way of participating in the development effort.

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TABLE I:

## Global Indicators of Agriculture's Role in the National Economy

	1946	1956	1960	1963	1970	1976	1984
National Income (1946=100)a	100	319	683	928	1,414	2,545p	4,836p
Agricultural Output (%)a,q	72	40	29	26	26	--	23r
Population (millions)b	9.3	9.4	10.8	11.6	14.0	16.2	18.5e
Agricultural labor (%)c	74.1	56.6	44.4	42.8	--	--	27.3r

## Notes:

Blank spaces indicate non-availability of data

e - author's estimate

p - planned output

q - as a proportion of industrial and agricultural product

r - information provided during visit, July 1985

## Sources:

a) Chung (1974, 1983).

b) Seekins (1981); 1984 estimate based on reported 1.6% growth rate

c) Chung (1974)

TABLE II:

Indicies of Agricultural and Food Production, 1962-1983  
(1969-1971 = 100)

	Agricultural Production	Food Production	Food Production Per Capita
1953a	37		
--			
1962	83	83	99
1963	87	84	100
1964	88	88	99
1965	86	86	93
1966	90	90	95
1967	90	90	93
1968	90	90	90
1969	93	93	95
1970	99	99	100
1971	108	108	105
1972	116	116	110
1973	118	118	109
1974	128	129	116
1975	137	138	121
1976	148	150	128
1977	159	160	134
1978	160	161	131
1979	168	170	135
1980	172	174	135
1981	175	176	134
1982	179	181	134
1983	189	191	138
Annual Rates of Growth:			
1953a-1962	9.5		
1962-1970	2.2	2.2	0
1970-1983	5.1	5.2	2.5

## Note:

a - output index based on Chung 1974:Table 14

## Source:

Food and Agricultural Organization of the United Nations (FAO),  
Production Yearbook, Rome, various years.

TABLE III:

**Grain Production and Yields: 1955-1983**  
(thousands of metric tons and tons/ha.)

	Rice		Maize		All Grains	
	Output	Yield	Output	Yield	FAO	Korean
1949						2,790
1956	1,400	2.8	760	1.2	2,870	
1961	1,600		1,200		3,400	3,800a
1965					4,500	
1968					5,700	
--						
1972	3,000		1,840		5,830	
1973	3,300	4.7	1,840		6,150	
1974	3,500	5.0	2,000		6,540	7,000
1975	3,700	5.1	1,700	4.0	6,750	
1976	4,150	5.4	1,780	4.2	7,330	
1977	4,610	5.9	1,820	4.4	7,790	
1978	4,500	5.8	1,850	5.1	7,780	
1979	4,800	6.2	1,950	5.3	8,250	
1980	4,800	6.0	2,200	5.8	8,500	9,000
1981	4,900	6.1	2,250	5.9	8,730	
1982	5,000	6.2	2,330	5.8	9,000	
1983	5,200	6.3	2,500	6.0	9,500	
1984						10,000

## Notes:

Blank space for yields 1972 to 1974 reflect inconsistent data  
a - 1960

## Sources:

1956, 1961 - Chung 1974: Table 17 based on U.S. Dept. of State  
revisions  
1965, 1968 - Moak 1974.  
1972-1983 - FAO, Production Yearbook, Rome, various years.  
Korean Grain Output - DPRK, 1983.



TABLE IV:

## Rice and Maize Yields: 1944-1980

	1944	1949	1960	1974	1980
Rice	2.5	3.0	3.1	5.9	7.2
Maize	.7	1.3	1.2	5.0	6.3

Source: DPRK 1983.

TABLE V:

Exports and Imports of Cereals and Other Agricultural Products  
(1960-1983)

	Exports		Imports		Exports		Imports	
	Rice	Maize	Wheat	Maize	Cereals	Total	Cereals	Total
	(millions of tons)		(millions of tons)		(millions of dollars)			
1960	19.4	19.4	72.1		2.2	7.9	5.4	
1961	22.5	2.6	430.0		2.9	6.8	33.5	
1962	0.3	12.7	94.9	5.0	.7	7.7	7.5	
1963		37.0	96.1		1.9	5.6	7.2	
1964		23.5	50.7		1.4	4.9	4.0	
1965	43.5		129.7	100.5	4.9	7.0	16.9	
1966	72.1	18.0	433.8		10.2	6.3	33.0	
1967	125.4	6.3	524.2		20.1	4.0	39.2	
1968	59.6	5.4	148.7		10.0	5.1	11.8	
1969	96.2	17.4	225.7		16.6	6.0	14.9	
1970								
1971						27.1b		77.8b
1972						28.6b		86.4b
1973						41.5b		193.9b
1974	300.0	250.0	950.6*	147.0	89.0	2.5	171.1	77.7
1975	340.0	200.0	300		130.0	22.8	95.0	85.2
1976	140.0	300.0	430		73.0	14.2	85.5	87.4
1977	290	300	450		120.0	12.8	75.5	96.1
1978	410	200	350		171.0	18.2	56.0	93.6
1979	300	200	470		140.0	19.1	96.5	125.6
1980	300		510		129.0	27.6	97.0	146.2
1981	300		720		135.0	28.4	158.0	121.2
1982	300		585		110.0	38.4	120.0	103.2
1983	200		350		70.0	32.6	68.0	109.2

## Notes:

All rice is calculated at milled weight = 65% paddy.

a - other agricultural exports

b - all agricultural exports and imports

\* - includes wheat flour at wheat equivalency

## Sources:

1960-69 - Scalapino and Lee 1972:1126, based on FAO sources

1974-1983 - FAO Trade Yearbook, Rome, various years.

TABLE VI:

**Land Use Patterns: 1983**  
(000 Has)

Annual Crops:		
Cereals		2318
rice	820	
maize	420	
millet	420	
barley	230	
wheat	180	
sorghum	124	
oats	87	
rye	37	
Pulses		330
soybeans	315	
Roots and Tubers		165
potatoes	135	
yams	30	
Vegetables and Melons		84
cabbage	27	
peppers	18	
melons	12	
Tobacco		40
Cotton		16
SUBTOTAL		2953
Fruit trees:		300
TOTAL CULTIVATED AREA		3253

Source: Annuals: FAO, 1983 Production Yearbook, Rome.  
Fruit trees: DPRK 1983

TABLE VII:

Fertilizer use: 1949-1984  
(Kilograms/hectare)

1949	1960	1963	1970	1975	1980	1984
131	160	300	510	1000	1600	2000

Source: Scalapino and Lee 1972:1186-87; DPRK 1983:72-3; personal interviews.

TABLE VIII:

## Per Capita Food Supply: 1961-63 - 1979-81

	1961-63	1964-66	1969-71	1974-76	1979-81
Calories					
Total	2,424	2,464	2,447	2,709	2,995
Vegetable	2,298	2,141	2,319	2,560	2,806
Animal	126	123	128	150	189
Proteins (grams)					
Total	71.8	70.9	72.3	80.4	84.6
Vegetable	60.4	59.8	60.8	66.8	67.8
Animal	11.4	11.1	11.6	13.6	16.8

Source: FAO, 1977, 1983 Production Yearbook, Rome.

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