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**APPROPRIATE TECHNOLOGY FOR SMALLHOLDERS:
SOME IMPLICATIONS OF SOCIAL STRATIFICATION
FOR FARMING SYSTEMS RESEARCH**

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ABSTRACT

APPROPRIATE TECHNOLOGY FOR SMALLHOLDERS: SOME IMPLICATIONS OF SOCIAL STRATIFICATION FOR FARMING SYSTEMS RESEARCH

Social stratification affects research and development activities in ways which are not recognized in the general farming systems literature. This becomes clear when one distinguishes among three strata of smallholders--petty commodity producers, peasants, and semiproletarians.

The basic thesis of this paper is that the socioeconomic characteristics of farming households and enterprises delimit the range of viable agronomic alternatives. Agricultural technologies have salient socioeconomic characteristics, which make them appropriate or inappropriate. This varies in ways which are known or knowable, and it is precisely the covariation of the socioeconomic characteristics of farming households and technologies which can help orient farming systems programs to specific constituencies.

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Social stratification affects research and development activities in ways which are not recognized in the general farming systems literature. This becomes clear when one distinguishes among three strata of smallholders--petty commodity producers, peasants, and semiproletarians. Consistent and important differences across strata exist and influence how one achieves agricultural objectives and how one designs technology to be appropriate. The purpose of this paper is to develop this argument in language accessible to non-social scientists.

Farming systems researchers rarely acknowledge that all smallholders are not alike. The category is heterogeneous. Variation occurs along two principal dimensions--the proportion of own farm production to total family income and the social organization of own farm production. These differences allow one to identify three principal groups--semiproletarians, peasants, and petty commodity producers.

The relative importance of farming to overall household income varies and allows one to distinguish between semiproletarians and other smallholders. Further distinctions may be drawn among smallholders who rely principally on own farm production. Peasants organize production primarily for subsistence and market surpluses; petty commodity producers orient their enterprises to the market.

These three strata are articulated into the overall economy in different ways, so the consequences of improving their agricultural productivity and standard of living will be different. One can outline strata-specific objectives and develop programs to raise producers' standards of living by

increasing the domestic availability of basic foodstuffs and/or improving general rural nutrition. These objectives are conceptually distinct and potentially in contradiction with others.

The distinction among semiproletarians, peasants, and petty commodity producers also reflects differences in the organization of household economies, specifically competitive demands on labor time and monetarization of on-farm production. This has direct consequences for the availability of both labor and cash inputs, which determine what kinds of technology could be adopted. Furthermore, the social organization of enterprises varies even within a single household economy when subsistence and commodity production coexist. Appropriate technology, therefore, varies not only across social strata but also across enterprises within each strata.

The basic thesis of this paper is that the socioeconomic characteristics of farming households and enterprises delimit the range of viable agronomic alternatives. Agricultural technologies--be they recommended cultivation practices or hybrid seeds--have salient socioeconomic characteristics, which make them appropriate or inappropriate. This varies in ways which are known or knowable, and it is precisely the covariation of the socioeconomic characteristics of farming households and technologies which can help orient commodity programs to specific constituencies.

CONCEPTUALIZING SOCIAL STRATA

There are several reasonable approaches to the conceptualization of social stratification among smallholders. Differences usually correspond to the disciplinary and/or theoretical orientations of authors, and the subtlety of some variations reflects the increasing sophistication of the literature. These discussions are largely inaccessible to practitioners of farming systems

research. Consequently, this section will attempt to translate complex theoretical notions in ways which do no gross violence to the sophistication and insights of the literature.

Definitions are embedded in theory, since they include what has been selected, highlighted, and interrelated. They also embody conceptions of social change, implicitly or explicitly reflecting both analyses of history and expectations of future change. Among the more controversial issues are the specificity of the peasantry and prospects for its future existence. Some opinion on these issues must inform any discussion, especially one oriented towards applications.

There are several dimensions to the discussion concerning the specificity of the peasantry. There is a debate about whether one should apply to peasant enterprises neoclassical microeconomic concepts, as advocated by some economists (Schultz, 1964; Becker, 1976), political economists (Popkin, 1979), and anthropologists (Leclair, 1968). The alternative position is that peasant enterprises are units of production and consumption, which obey a logic different from capitalist firms. This position is adopted by scholars as diverse as Chayanov (1966), Redfield (1956), Wolf (1966), Galeski (1972), and Scott (1976). It is reflected in definitions such as that of Shanin which considers the peasantry to have four characteristics--

the family farm as the basic multifunctional unit of social organization, and husbandry and usually animal rearing as the main means of livelihood, a specific traditional culture embodied in the way of life of small rural communities and multidirectional subjection to powerful outsiders (Shanin, 1973:140).

One variant of the general specificity argument is that there is a distinctive "peasant mode of production," which coexists with (Chayanov, 1966) or is subsumed by (Vergopoulos, 1978) other modes of production. Interpretations phrased in the language of articulation raise esoteric issues, (Foster-Carter, 1978), which merit at least a brief commentary.

Any conceptualization of a mode of production must specify mechanisms which reproduce the social relations of production characteristic of that mode (Taylor, 1977). One might tentatively define patriarchy as the foundation for the social relations of peasant production, thereby arguing that control by male head of house over family labor typifies the labor process. Patriarchal relations are reproduced within the family and are supported by the institutional nexus within which peasants are embedded. This interpretation may be quite erroneous, but it has the merit of specifying the social relations which are characteristic of and reproduced within the purported mode of production. Patriarchy is a critical issue among agriculturalists, especially because the division of labor and the coexistence of male and female enterprises is complex. This should be addressed directly because it has theoretical and practical implications.

Fortunately, one need not defend a peasant "mode of production." It is sufficient to identify family labor power as a critical element in the organization of peasant economies and to consider how modifications in its deployment affect the reproduction of peasant households. The model developed by Deere and de Janvry (1979:603) facilitates this: Family labor power is organized in a home production process, the product of which is analytically rent. Products are consumed on-farm for their use values and/or sold as commodities for their exchange value. The means of production, including raw

materials, the means of work, and family labor power, which were used up in the cycle of production must be replaced. Analytically, this is the process of reproduction which is the basis of differentiation and stratification (Deere and de Janvry, 1979:602-603).

This model provides basic elements for characterizing social strata. Peasant households rely principally on family labor, organize production primarily for its use value, and experience a process of simple reproduction. The economic, political, and social networks in which peasants are embedded siphon off surplus and limit differentiation. Nevertheless, peasant communities are stratified (Lenski, 1965:243-296), and recently the pace of change has accelerated.

The penetration of capitalism and the spread of commodity production disrupt the simple reproduction of peasant households. Different social strata emerge, as households move either towards expanded reproduction or towards decomposition. This is the differentiation of the peasantry (Lenin, 1977:175-192); Harrison, 1977). Petty commodity producers, peasants, and semiproletarian households reflect different dimensions and directions of the same historical process.

In comparison with peasants, petty commodity producers rely more heavily on hired labor, produce commodities, and depend on cash income to experience expanded reproduction. Because they are so involved in and dependent on the market, terms of trade and similar issues of agricultural policy are more important to petty commodity producers than to peasants. If expanded reproduction is successful, they become farmers (Murmis, 1980).

Semiproletarian households have insufficient means of production to absorb family labor. Consequently, they depend on the sale of labor power and

experience the decomposition of their own enterprises. Their interests are served by programs which increase rural employment and wages.

Differences among these strata are actually a matter of degree because the allocation of labor and destination of the product varies both between and within strata. Nevertheless, the approach is useful because it suggests how the reproduction of farming households can be threatened. This, in turn, suggests how one can tailor strategies to different strata and enterprises.

GENERAL POLICY OBJECTIVES

Petty commodity producers, peasants, and semiproletarians are involved in agricultural production in ways which vary across strata and enterprises. This implies that state policies can be directed both across and within strata to achieve different objectives. Clarity is important if farming systems programs are to articulate objectives and identify appropriate constituencies.

Farming systems programs can pursue several objectives, one of which is to increase the market availability of basic foodstuffs. In many countries, concern exists to maintain production for export and to increase production for the domestic market. The expenditure of foreign exchange for commodities which could be produced domestically is visible, and the fear of urban revolts over high food prices is real. Many countries are not redistributing productive resources, and even some that are (e.g. Nicaragua, Collins, 1982) retain smallholders as producers of staples. The political context of smallholder production clearly varies. For different reasons, therefore, researchers may develop farming systems programs for smallholders.

A central objective could be to improve productivity, thereby increasing cash income of producers and market availability for consumers. In this case, it is appropriate to orient a farming systems program toward small-

holders who are already involved in commodity production. The probability is high that there exists a relevant experimental literature, experienced researchers, and a support network of International Agricultural Research Centers and Collaborative Research Support Programs (CRSPs). These resources facilitate adaptive research.

The technology developed by national and international institutions is likely to require some cash expenditures. Precisely because they are already involved in market production, petty commodity producers can tolerate monetary outlays. The probability that technology can be developed and adopted is high, and results would be visible in the marketplace.

A farming systems program serving small scale commercial producers differs from a conventional commodity program in one important way. One analyzes commodity production in the context of other enterprises, recognizing the potential for competition between enterprises. One does not assume that conflict should be resolved in favor of commodity production. Rather, one acknowledges that producers may have a multiplicity of objectives and, therefore, criteria to evaluate success. The maintenance and improvement of subsistence production may be threatened by commodity production.

This introduces another objective of farming systems research--to improve the productivity of subsistence enterprises, thereby increasing on-farm consumption and improving rural nutrition. This objective is appropriate for programs directed at petty commodity producers, who can use subsistence enterprises as high value dietary supplements and as emergency reserves. Researchers must determine how commodity and subsistence enterprises can coexist.

To improve productivity in order to increase on-farm consumption must be the central objective in farming systems programs oriented to peasants.

Increased productivity may eventually result in marketable surpluses, but attention must focus on enterprises organized for their use value. Households do not necessarily enjoy a higher standard of living because they increase cash income. They can sell high value and purchase low value commodities, thereby jeopardizing nutrition (Dewey, 1981). The relationship between increased productivity and improved standard of living is problematic (Fleuret and Fleuret, 1980). Consequently, farming systems teams must abandon the technocratic myopia which sees increased market production as the only legitimate goal.

The logic of subsistence enterprises is different from that of commodity enterprises, so criteria for appropriate technology are different. Because subsistence production does not enter a cash nexus, the enterprise cannot recover in the market monetary costs required for production. Consequently, inputs into subsistence enterprises should minimize cash outlays. If surpluses can eventually be produced and sold, this constraint can be relaxed. Even if market factors are considered, however, focus must remain on the needs of the household for consumption.

If producers organize enterprises for subsistence, the analysis of consumption patterns and preferences must be integral to the research endeavor. The cycle of agricultural production includes raising crops or animals, primary food processing, on-farm storage for consumption, and on-farm seed storage. It should also include the maintenance of tools and infrastructure. These activities collectively are what Deere and de Janvry (1979) mean by the reproduction of the means of production.

To deal effectively with the entire cycle of agricultural production demands collaboration across several disciplines. Most agricultural research

centers are not organized to facilitate this. Programs directed at small scale commercial producers can use existing commodity programs as a center of gravity which incorporates other programs and support departments. Programs directed at peasant producers have no natural organizational form.

The bureaucratic or formal organization of farming systems programs requires far more attention than it has received. Organization is related not only to effective field work but also to on-station research and development activities which are tailored to subsistence enterprises. National and international centers were not created to conduct farming systems research, and it may require major reorganization if they are to do more than move experiments off-station and into smallholders' fields.

There are compelling reasons to suggest that fledgling programs in farming systems research begin with petty commodity producers and expand to peasants. This progression is most likely to produce demonstrable successes and to develop team skills, thereby winning legitimacy for the program. Eventually, one could expand the program to semiproletarians.

Semiproletarians are extremely problematic for farming systems researchers. To the extent that they are concentrated on small plots in ecologically marginal zones, the productive potential of the agricultural base is low. Migration limits the availability of labor for on-farm production, and deterioration of infrastructure may leave the household with poor implements of production. Because on-farm production is low, off-farm income can be a very substantial proportion of total family income. The probability that even a successful farming systems program will change that reality is very low, and it decreases as the degradation of the environment increases.

Governments may wish to mitigate the poverty of semiproletarian households, but they may do little more than demonstrate concern. Integrated rural development projects can encourage collaboration among government agencies and provide important social services. Cooperation is also possible between national agricultural research institutions and private voluntary organizations, which actually work in semiproletarian communities. Both approaches have symbolic merit, but it requires both commitment and sophistication to design an agricultural program which actually makes a difference under very adverse circumstances.

Rhetorically, it is convenient to muddle the relationship between social stratification and viable objectives for farming systems programs. A muddle allows one to believe that all smallholders will benefit equally. It also encourages one to define as complementary rather than competitive general objectives such as increasing the domestic availability of staples, improving rural nutrition, and mitigating poverty in the most disadvantaged groups. Interrelating strata differences with viable objectives, however, provides a better guide to planning. The next sections will illustrate this thesis.

PETTY COMMODITY PRODUCERS

Farming systems research can increase domestic production of staples by helping petty commodity producers improve practices, productivity and thereby market availability. Such programs can raise producers' standards of living, primarily by increasing cash income from the sale of agricultural products and incidentally by improving subsistence production.

Programs for small scale commercial producers can develop existing commodity programs and tap the resources of the international agricultural community. Commodity programs in basic grains and foodstuffs are likely to be

more recently established, less well staffed, and more poorly funded than established programs in export commodities. Assistance in developing locally suitable technologies is available from the International Agricultural Research Centers and through the Collaborative Research Support Programs (CRSPs). Technologies for petty commodity production are better developed than are techniques requiring minimal cash inputs. Consequently, national research centers are in relatively strong positions to elaborate research and development programs for petty commodity producers.

One can use the techniques of production or microeconomics to evaluate appropriate technology (Hildebrand, 1979; Casley and Lury, 1981). Petty commodity producers realize monetary expenditures for labor and other productive inputs and receive cash upon sale. They calculate profit and loss and include economic rationality among their evaluation criteria. Criteria of producers and agricultural economists may differ in detail, but both regard farms as enterprises which should produce a product and realize a profit. Agricultural economists are trained to be more effective with petty commodity producers than other strata of smallholders. This is important because they are likely to be the only social scientists employed by national agricultural research institutes.

Farming systems programs which serve petty commodity producers maximize the strengths of commodity programs, international resources, and in-house social scientists. This provides a relatively strong basis for moving beyond conventional activities, considering both the entire cycle of commodity production and relationships between commodity and subsistence enterprises.

The overall objective of a farming systems program is that petty commodity producers increase their standard of living because of improvements

in their commodity producing enterprises. Research must, therefore, focus on technologies which lower the costs of production, thereby improving profitability. In this context, market analysis is critical.

Most commodity production relies on purchased inputs, including seeds, fertilizers, and other chemicals. Whether these inputs are fresh and available in adequate quantities is critical information for program development. Equally important is instruction about their use. In many countries, manufacturers of agrochemicals teach both merchants and producers about products. The economic incentive for overuse is clear, and the ability of extension agents to counter such recommendations is limited. No realistic program can proceed without information about the availability of agricultural inputs and the recommendations of private and public sources (INIAP/Cornell, 1982).

There are both economic and ecological reasons to develop varieties with genetic resistance to major diseases and pests. Even as basic and applied research continues, however, seed improvement programs can begin on-farm. Technologies can be adapted for on-farm production by emphasizing selection for disease resistance and storage for good germination (Arevalo, 1983). Producers thereby gain some independence from the market and increase control over the genetics of the crop. Control can potentially lower the costs of production, thereby increasing profitability.

In marketing agricultural products, small scale producers are usually at a disadvantage. Prices at the point of production tend to be low, whereas prices in central cities tend to be high. Disadvantages to smallholders which are a consequence of market structure are compounded if merchants are the principal or only source of credit for production and if loans must be repaid immediately after harvest (Barril, 1983). These issues must be explored to

determine if producers or merchants are more likely to benefit from a farming systems program.

One important issue is the ability of small scale producers to withhold commodities until prices rise. Sometimes the problem is economic, e.g., adequate on-farm or cooperative storage facilities. Sometimes the issue is biological, e.g. pest infestation and loss (Arevalo, 1983). A comprehensive farming systems program, especially if it served an integrated rural development district, could explore the technical aspects of immediate post-harvest storage. One could consider cooperative and/or farm level storage facilities and medium to high input technology to prevent losses during the short term. The cost to construct storage infrastructure should be minimal, but cash outlays for agrochemicals are acceptable because turnover will be rapid.

Storage for on-farm consumption should be encouraged for commodities with high nutritional value. It is a known danger (USAID, 1982), that producers sell high value products and buy commodities of lesser nutritional value. Under these circumstances, cash income can increase even as nutritional status decreases.

Researchers must develop several storage technologies--to preserve seed for the next season, to withhold crops during the immediate post-harvest period, and to retain grains for personal consumption. Petty commodity producers can tolerate medium cash inputs on storage for personal consumption, but concern should focus on the appropriate use of safe agrochemicals.

It is desirable to diversify commodity enterprises so that producers are not entirely dependent on a single market over which they exercise little control. This can be achieved by maintaining multiple enterprises during a single season and/or by rotating commodities during subsequent seasons. A

major limitation on diversification is environmental--what will do well, given the basic criterion of profitability.

It is the criterion of profitability which makes it difficult to accommodate subsistence cropping enterprises, except on lands unsuitable for commercial production. Petty commodity producers will probably not feed themselves. They may retain more for their own use, but they will probably continue to purchase most of the processed and unprocessed vegetable products they consume.

Petty commodity producers may also benefit from small animal enterprises which are organized for subsistence. Especially if these enterprises are managed and controlled by women, they can complement commodity producing enterprises. Small animals can be sold in emergencies to meet special bills, thereby serving as the walking fund for petty cash. Furthermore, they provide high value, complete proteins, thereby supplementing a vegetable based diet.

Researchers would need to determine which animals petty commodity producers could support. The resource base necessary to support different species of minor livestock obviously varies, as does their adaptation to particular environments and their ability to use residues from cropping enterprises (McDowell and Hildebrand, 1980). Finally, labor demands also vary. All these variables would need to be considered before recommending minor livestock to particular producers.

Subsistence enterprises, both minor livestock and crops, are likely to be ignored in traditional programs for petty commodity producers. Furthermore, the analysis of commercial enterprises is likely to be incomplete, focusing on the first stage in the process of production, to the relative neglect of post

harvest issues. A farming systems approach, by contrast, goes beyond traditional commodity programs to provide more comprehensive analyses.

PEASANTS

Farming systems programs can improve rural nutrition by helping peasant producers to improve practices and productivity, thereby increasing the availability of foods for on-farm consumption. In the short run, such programs can improve producers' standards of living primarily by increasing the productivity of subsistence enterprises. Later, they may permit peasants to produce a marketable surplus. Initially, however, farming systems programs properly focus on subsistence rather than commodity enterprises.

The subsistence enterprises of peasant producers are likely to involve associations of more than one crop (Kass, 1978; Jodha, 1980). Such enterprises immediately challenge commodity orientations. Even preliminary attempts to identify constraints require expertise in several crops; serious analyses require the specification of possible complementarities and competitions (Harwood, 1979). Nevertheless, the training of technicians, the formal organization of institutions, and the reward structures of disciplines do not encourage such multidisciplinary analysis (Gilbert et al., 1980:77-81). These issues must be addressed if national and international agricultural research centers are to develop the capacity to understand and improve subsistence enterprises.

Peasant households organize agricultural production in complex ways. There may be important religious meaning to how and when one plants specific crops. Furthermore, there may be post-harvest celebrations which require special dishes (Dillon, 1982). Such rituals and holidays may themselves become determinants of the agricultural calendar.

Peasant communities are integrated by kinship, so the nuclear family is sometimes inappropriate as the unit of analysis. Kin relationships, fictive or otherwise, imply obligations to redistribute resources. One important exchange involves labor. Households can sometimes claim for personal or communal purposes access to the labor of community members. They have corresponding obligations to provide labor if requested by others. These exchanges have a calculus, but it is not that of the wage labor nexus. Reciprocal labor can be important to analyses of labor utilization on peasant farms (Mayer, 1974).

The division of labor between men and women, children and adults is fundamental to the organization of peasant production (Hanger and Moris, 1973; Stoler, 1977). There are two basic issues--making decisions and allocating tasks. Within a single enterprise, there may or may not be coincidence between decision making and task allocation. Furthermore, the pattern may vary across enterprises. The identification of "his," "her," and "our" enterprises is related to patterns of financial responsibility or household budgets. Who assumes responsibility and controls the proceeds of an enterprise is information which allows one to anticipate the consequences of programmatic intervention (Palmer and von Buchwald, 1980).

Peasant economies have been defined as being oriented primarily to subsistence rather than to commercial production. This does not mean that they are natural economies, in which households produce whatever they need and engage in minimal barter or trade. The historical process by which peasants became incorporated into a money economy obviously varies (Skocpol, 1979). In contemporary Latin America, however, most peasants are integrated in two

ways. They exchange some of what they produce for ritual and/or industrial goods. They also sell labor power for a wage (de Janvry, 1981).

Farming systems research must explore how this cash is used. Cash income might supplement subsistence production and subsidize consumption. Alternatively, it might finance investment in productive infrastructure, thereby permitting the expanded reproduction of peasant economies. The consequences of each alternative are radically different, and researchers presumably wish to encourage the second.

In order to site projects, researchers must make educated guesses about regions with viable possibilities for expanded reproduction. Socioeconomic and environmental data are both relevant. Agricultural census data allow one to identify regions with moderately equitable patterns of land distribution (Palacios and Garrett, 1983). Precipitation data allow one to identify zones in which annual variations are not dramatic and the basic rainfall pattern is appropriate for specific varieties (Staver, 1982). Both an adequate resource base and a moderately predictable environment would seem to enhance the likelihood of a successful farming systems program.

Peasant enterprises are typically characterized by diversity. Farming systems programs should attempt to maintain this diversity, even as research focuses on increasing the productivity of dietary staples. Available technologies probably require some purchased inputs. In this case, on-farm trials can seek to establish the best low level option for peasants. Other experiments can also be attempted, including the modification of cultivation practices and the addition of new varieties into cropping systems (Ruano, 1984).

A less traditional approach is also appropriate. Seed selection and storage offer immediate opportunities for improving the productivity of peasant enterprises without disrupting them. In many communities, women select for seed by inspecting the crop after harvest and by choosing desirable specimens (INIAP/Cornell, 1982). These women might be instructed to examine the crop in the field and to tag plants with desirable characteristics, e.g., disease resistance or adequate stover. Women could tailor seed selection to household needs by applying comprehensive criteria in the final selection process.

Seed thus selected must be stored properly to minimize infestation and to protect germination (UNECA, 1976). Researchers can support this effort by exploring low input technologies and evaluating them under farm conditions. Viable technologies for on-farm seed storage must be developed if improved seed selection and storage are to be a principal means to increase productivity in the short run.

If productivity actually increases, grains must be protected longer from post-harvest losses. This introduces the question of on-farm storage for household consumption. Because this is eminently a problem of subsistence, cash inputs should be minimal. This is a serious limitation on appropriate technology. If the technical problem cannot be solved, productivity increases can disappear as post-harvest losses.

Increasing productivity should also result in marketable surpluses. It is desirable that these surpluses occur periodically throughout the year so that they provide a steady source of income. Particularly desirable are early maturing varieties of dietary staples which can be consumed and sold before the peak season of traditional varieties. Such varieties can meet

nutritional needs at the "hungry time," and they can claim premium prices early in the season (Staver, 1982).

Small animal enterprises can be approached for a similar perspective. In peasant households, however, serious attention must be accorded large animal enterprises. There are communities, like San Francisco de Natabuela in Imbabura, Ecuador (INIAP/Cornell, 1982), in which peasants spontaneously discuss how they attempt to close the feed/animal/manure/crop cycle. Animals are recognized as important to cropping cycles, so important that share arrangements regarding animals specify who receives the manure. Such self-conscious attempts to intensify animal/crop interactions may not characterize all peasant communities, but they do suggest lines for appropriate research.

Proper accommodations for different animals is another relevant issue. There is apparent consensus that livestock represent valuable sources of complete proteins, emergency cash, long term savings, and power for production (Sprague, 1976). Exactly what makes animals valuable to peasant enterprises also makes them attractive to thieves, but there seems to be little consensus how to protect them. Researchers could consider local needs and design constructions which protect animals from the elements and from predators, human and otherwise.

Farming systems researchers should focus on peasant subsistence enterprises. Promising lines of research and intervention are likely to be overlooked if attention is confined to minimal levels of agrochemicals. Immediate and possibly dramatic improvements may be achieved by teaching women comprehensive criteria for seed selection and by developing appropriate seed storage techniques. Expected increases in productivity raise the issue of on-farm storage for consumption. This illustrates why increasing productivity

and decreasing post-harvest losses must be complementary approaches in farming systems programs for peasants.

SEMIPROLETARIANS

Farming systems research can do little to benefit semiproletarian households. This is almost a matter of definition, since on-farm production provides the minority of total income. Standard of living, therefore, is more responsive to changes in wage rates. Improved productivity of own farm enterprises is beneficial, but better social services and higher wages are relatively more important to semiproletarian budgets.

Semiproletarian households are likely to be concentrated in agriculturally marginal areas. This introduces technical problems. Crops or crop associations which do well in marginal environments may not be well researched. Traditional Andean grains and tubers provide good examples. There is little published research on crops like the legume choco (lupinus) and the tuber oca (oxalis) (León, 1964). Nevertheless, they are important on high elevation, marginal farms in Ecuador (INIAP/Cornell, 1982). Farmers know more than agronomists about these crops, and scientists need to study traditional systems before suggesting improvements.

Marginal and fragile environments are problematic, especially if traditional practices have been intensified. Many communities have experienced changes in land use patterns, irrigation systems, rotation practices, and the availability of lands for pasture and fuelwood. The net result can be intense and rapid environmental degradation (Hoskins, 1979). Farming systems researchers must consider environmental issues to develop practices which avoid further environmental degradation and decomposition of subsistence economies.

The availability of labor, especially male labor, is another critical issue. Migration alters the complementarity of male and female activities and creates extra work. Male migration is frequently associated with female maintenance of farms (Boserup, 1977;). This can substantially lengthen the working day for rural women (UNDP, 1980). Alternatively, male migrants can coordinate activities so that they return regularly and retain principal responsibility for on-farm production (INIAP/Cornell, 1982). In this situation, men are overworked.

In the short run, migration increases someone's workload. In the long run, the risk is that maintenance of farm infrastructure--fences, canals, tools, etc.--will be postponed. It is possible that failure to maintain infrastructure is the most critical factor in accelerating the decomposition of semiproletarian households (Chaney and Lewis, 1980). This hypothesis deserves serious attention.

Programs for semiproletarians face severe limitations. Own farm production is not the principal source of income. Furthermore, land bases are likely to have limited productive potential and migration necessarily stresses the farm. Under these circumstances, strategies to increase on-farm production are difficult to identify.

Technologies requiring minimal cash inputs are generally suitable. Semi-proletarians can, therefore, benefit from farming systems programs directed at peasants. Especially important are technologies which maximize seed selection for desirable characteristics. It is important to minimize loss of grains stored for consumption, but this storage lasts only a few months. More critical is the safe storage of seed for the next season, because benefits reappear. This dynamic is much like that in peasant households. Particularly

beneficial are early maturing varieties which can be consumed or sold before traditional varieties are ready (Staver, 1982).

The limited land bases of semiproletarians mean that farming systems programs cannot focus on cropping enterprises alone. Small animal enterprises may present viable opportunities. One example is guinea pigs in Ecuador. These animals are typically maintained by the female head of house, who controls both their care and their sale. Guinea pigs usually wander throughout the house and eat grasses collected by women and/or children. Animals are consumed by the family or sold by female head of house. When sold, they command a good price, equivalent to one day's wage for unskilled, male agricultural labor (INIAP/Cornell, 1982).

One can increase the productivity of small animal enterprises by developing low input techniques to improve indigenous species, to increase the nutritional value of forages, and to confine animals in pens constructed from local materials. Initially, available research can be adapted; eventually, research must be customized. In the short run, however, even modest adjustments can produce substantial returns for small scale animal enterprises.

Farming systems programs can develop strategies which minimize reliance on land and male labor and emphasize small animals and female labor. Successful programs can help semiproletarians consume complete proteins and sell traditional animal products, at the discretion of female head of house who manages the enterprise. Even though semiproletarian households do not receive the majority of their income from on-farm production, a strategy to improve very small animal enterprises seems to have merit.

CONCLUSION

The social organization of agricultural production and agrarian communities have been traditional foci for research in the social sciences. Major dimensions along which household economies and agrarian communities vary are known. Similarly, basic relationships between the socioeconomic characteristics of farming households and the technology they use in production is known. The problem is that these relationships are not known by those who develop agricultural technologies.

Social scientists can use theoretical and ethnographic literature to focus farming systems research. There is, of course, a specificity about agricultural production, and no reasonable person would suggest that research agendas be developed independent of field work. Nevertheless, one can theorize about issues which are central to different social strata. One can specify objectives for petty commodity producers, peasants, and semiproletarians.

(insert figure one here)

Theorists may find it painful to reduce esoteric debates to a chart with twenty-seven cells; ethnographers may challenge variables which are used to define the cells. Both protests are valid, but there is still something to be said for clarity--errors will become apparent.

The real purpose of this paper is to be specific enough that others can challenge the argument. Petty commodity producers, peasants, and semiproletarians are all smallholders, but they are different social strata. Farming systems programs must reflect these differences by tailoring programs to different strata and enterprises. One set of recommendations is summarized in Figure One. They can be applied and challenged if inadequate.

Figure 1

SUMMARY OF VIABLE FARMING SYSTEMS RESEARCH OBJECTIVES FOR THREE SOCIAL STRATA

PETTY COMMODITY PRODUCERS

PEASANTS

SEMIPROLETARIANS

<p>I. GENERAL ECONOMIC AND POLITICAL OBJECTIVES</p>	<p>Increase domestic food availability, thereby improving access of rural and urban workers to nationally produced wage goods</p>	<p>improve rural nutrition in the short term and increase domestic food availability in the medium term</p>	<p>demonstrate governmental concern with plight of rural poor, although agricultural results will be minimal</p>
<p>II. EXPECTED BENEFITS TO PRODUCERS</p>	<p>improve producers' standard of living primarily by increasing cash income and incidentally by increasing production for home consumption</p>	<p>improve producers' standard of living primarily by increasing production for home consumption and thereafter generating marketable surpluses</p>	<p>make minimal improvements in standard of living, primarily by increasing productivity of low input technologies, especially in small animals</p>
<p>III. CROP PRODUCTION ON FARM</p>	<p>increase productivity and variety of commercial crops; specifically, decrease costs thereby increasing profits and diversify to decrease dependence on a single commodity</p>	<p>maintain diversity of crop production and increase productivity of dietary staples; specifically, emphasize modifications of cultural practices, the incorporation of new varieties into polycultures, and the establishment of more comprehensive criteria for seed selection</p>	<p>recognize that only marginal improvements in cropping enterprises are possible given limited landbases, fragile environments, and reliance on crops which have not been the object of much research</p>
<p>IV. LIVESTOCK PRODUCTION ON-FARM</p>	<p>maintain or reintroduce small numbers of minor animals which can be sold for petty cash and used for family subsistence</p>	<p>assign high priority to maintain diversity of animal species and to tighten the feed/animal/manure/crop cycle; maintain small animals which can be sold for cash as needed in emergencies, and consider programs and constructions which discourage theft of larger animals</p>	<p>pursue possibilities to develop small animal enterprises, especially if species can be maintained with minimal expenditures of cash and labor and if they can either be consumed or sold at the discretion of female head of house</p>
<p>V. MARKETING</p>	<p>determine whether supply of necessary inputs is approximately adequate to projected demand; evaluate adequacy of technical information provided by both commercial and state purveyors; develop and disseminate appropriate recommendations using traditional extension techniques.</p>	<p>study minimal but effective levels of chemical inputs and develop best low level option; emphasize improved practices of seed selection/storage and better integration of animal/plant enterprises</p>	<p>minimize market involvement and maximize on-farm production of inputs into subsequent production processes</p>
<p>VI. SALE OF AGRICULTURAL PRODUCTS</p>	<p>recognize that marketing problems are potentially more serious and less tractable than production problems, especially if producers must sell to specific merchants to obtain credit</p>	<p>emphasize an annual pattern of marketable surpluses so that some crop or animal is available for sale throughout the year</p>	<p>consider the special merits of small livestock which can be consumed or sold upon demand</p>
<p>VII. PRODUCTION AND STORAGE OF SEED</p>	<p>develop techniques for on-farm production, storage, and selection of better seeds; emphasis is on proper storage for disease resistance and germination so that producers can avoid seed purchases prior to sowing</p>	<p>work with traditional seed selectors/storers (women) to identify and tag plants with advantageous characteristics, thereby improving farm-level varieties; develop low level technologies to store planting materials, selected using comprehensive criteria</p>	<p>involve private voluntary organizations in seed selection/storage research with peasants so that they may disseminate results to semiproletarians; initial emphasis should be on safe storage of minimal quantities, followed by field selection criteria</p>
<p>VIII. STORAGE OF GRAINS FOR HOUSEHOLD CONSUMPTION</p>	<p>on-farm storage technology should be safe, requiring medium cash inputs; specifically, producers should be able to hold crops off market during immediate post-harvest period and thereafter experience minimal losses of grains retained for household consumption</p>	<p>on-farm storage technology should be safe and effective, requiring low cash inputs and remaining effective during the entire period that crops are stored; specifically, as harvests destined for subsistence increase, the time grains need to be protected also increases.</p>	<p>on farm storage technology should be safe, requiring zero to low cash inputs; specifically, seed selection and storage is more important than storage of subsistence production, given the short time that their production lasts</p>
<p>IX. SUMMARY OF OBJECTIVES FOR STRATA SPECIFIC APPROPRIATE TECHNOLOGY</p>	<p>tolerate medium to high cash inputs during process of production, immediate post harvest storage, and seed storage for next planting; buffer necessity to buy seed or sell produce when vulnerability to market has greatest potentially negative consequences</p>	<p>emphasize medium to low cash inputs, with special attention to low costs in the early stages of the production cycle; emphasize low to zero cash expenditures, especially to select and store planting materials and to protect grains for household consumption</p>	<p>consider low to zero cash inputs throughout cycle of production and consumption; emphasize simple seed selection and post harvest techniques, using available materials, and considering the probably low availability of male labor</p>

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