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SUB-OPTIMAL PROGRAMMING METHOD IN FARM PLANNING: COMMENT

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Powell and Hardaker's article "Sub-optimal Programming Methods in Farm Planning"[1] prompts this comment regarding the logic of their approach. Discussion is directed toward the concept of sub-optimization. At first glance the term sub-optimal programming implies a farmer goal of inefficiency. If an optimum solution to a problem denotes maximum economic efficiency, then any attempt to achieve a less than optimum solution denotes less than optimum economic efficiency—hence inefficiency. Would this be rational decision-making? Certainly not in the traditional context of economic theory. Do Powell and Hardaker support farmer goals of inefficiency? Surely not. The key may lie in the specification of the problem and the reference toward which optimization is directed. That is, profits may not be the only criterion for optimization.

They express disenchantment with the unique optimum solution generated by linear programs because of the limitations of the technique, including perfect certainty, and because of complex multi-goals of farmers. But is linear programming so dormant on these counts that one must turn to sub-optimal methods? Linear programming offers the opportunity for specification of a wide variety of firm attributes including the behavioral attributes of the decision-maker as well as the consideration of production, market, and financial relations. Furthermore, the feasibility of single valued expectations rests on the value of a more complete specification of the model, including the expression of risk aversion, and on the intuitive appeal that, over multi-periods, departures from mean expectations are likely to occur in both directions and are likely to be offsetting.

While linear programming permits the consideration of but one objective function, the feasibility of multi-variate objective functions has clearly been demonstrated.[2] In this instance the decision-maker's objective included components of growth in asset equity, consumption, and security in terms of a borrowing reserve.

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[1] R. A. Powell and J. B. Hardaker, "Sub-optimal Programming Methods in Farm Planning", *Review of Marketing and Agricultural Economics*, Vol. 37, No. 2 (June, 1969).

[2] P. J. Barry, "Reservation Prices on Credit Use Over Time: Implications for Growth of Cash Grain Farmers" (University of Illinois: Unpublished Ph.D. Thesis, 1970).

Powell and Hardaker initially report two methods for generating sub-optimal solutions for linear programming. One involves the violation of the optimal solution by non-basic activities; the other is the acceptance of an iterative solution below the optimum. While these are mechanically possible, the logic which must justify their selection seems insupportable. What possible reason could there be for a decision-maker to accept a sub-optimal solution when the specified activities and constraints allow him to meet his specified objective in an optimal fashion? If the decision-maker is not satisfied with the optimal solution generated by his specified programme, the obvious course seems not to choose a less than optimum solution; rather, it seems appropriate to respecify alternatives, constraints, and/or objectives so that they better describe the decision-making situation.

In this context, Powell and Hardaker point out the possibility of adding further constraints to the problem, or changing existing constraints. The varied constraints which are suggested are generally related to secondary objectives or minimum income levels. Does this approach to model specifications suggest sub-optimal solutions in either a linear programming or empirical decision-making context? They appear to suggest a respecification of the decision-making framework to take additional account of the behavioral attributes of the decision-maker. The decision-maker still seeks an optimal solution given his constraints and his preferences as to activities and objectives.

Optimization must be in reference to various conditions. These are easily recognized in linear programming as activities, constraints, and an objective function with perhaps several components. But more important yet is the empirical orientation of these conditions. Powell and Hardaker seem to have focused on the production organization of farms. A more comprehensive approach might consider the optimal production, market, and financial organization of the business with consideration given to the behavioral attributes of the farm decision-maker. These can be specified in linear programming.