11 New Crop Varieties: Impact on Diversification and Stability of Yields

11.1 INTRODUCTION

In the preceding chapters, and in earlier publications, we have isolated increased multiple cropping (Alauddin and Tisdell, 1986c) and increased control over agricultural micro-environments due to greater use of HYV-associated techniques (Alauddin and Tisdell, 1988d) as significant factors contributing to reduced relative variability of crop yields with the adoption of HYVs. However, we have not given in-depth attention to the possibility that a contributor to this result may be increased crop diversification, especially greater diversity in varieties of the same crop. In this chapter we extend our earlier results by concentrating on the diversification aspect.

In so doing, we apply portfolio diversification analysis to this issue, make use of lower semi-variance and Cherbychev’s inequality, and for the first time derive, from Bangladeshi data, trends in semi-variances of foodgrain yields and probabilities of disaster yield levels as well as shifts in the efficiency locus for the mean yield/semi-variance of foodgrain yields. But even if this efficiency locus shifts outward, it may not in fact be associated with greater crop diversification. We provide evidence from two Bangladeshi villages which indicates that the range of rice crop varieties grown is becoming less diverse. From a risk point of view this may not be a major problem unless existing varieties disappear. If all existing varieties remain in existence, farmers always have the option of choosing their old portfolio of cropping combinations, and if they do not choose them then, on the surface at least, they regard the new combination as superior. But if existing varieties disappear, then the available portfolio can change irreversibly and raise problems that may be overlooked in short-period diversification analysis. Let us consider these issues in the remainder of this chapter.
11.2 FACTORS CONTRIBUTING TO DECLINING INSTABILITY OF FOODGRAIN YIELDS

There is increasing evidence that the introduction of HYVs is associated with a fall in relative variability of foodgrain yields and has been widely observed in relation to rice. This appears to be so in Bangladesh. Three factors may help to explain this: (1) increased incidence of multiple cropping; (2) greater use of techniques such as irrigation which exert more control over crop environment; and (3) greater scope for crop diversification as new varieties are added to the new stock. We have previously provided evidence to show the significance of the two factors first mentioned (see Chapters 9 and 10; Alauddin and Tisdell, 1986c; 1988c; 1988d). We wish here to concentrate on the possible significance of the diversification aspect, to apply portfolio analysis to the subject, and in particular to consider the impact of HYV adoption on the mean yield/risk efficiency locus for foodgrains, paying particular attention to the lower semi-variance as a measure of risk or variability. To that end this section deals with conceptual issues, whereas the following section examines trends and shifts in the lower semi-variance, coefficient of lower semi-variation and shifts in the efficiency locus, mean foodgrain yields and lower semi-variance of these yields.

The Green Revolution has had a strong effect in raising average or expected yields of crops (Herdt and Capule, 1983; Alauddin and Tisdell, 1986c). This is because in some cases HYVs raise within-season yields when they replace traditional varieties, as well as increasing the scope for multiple cropping, and so on an annual basis also add to expected yields. If a single crop of an HYV has a lower yield than a single crop of a traditional variety, and if the former permits multiple cropping but the latter does not, annual expected yield may be much higher with HYV introduction. To the extent also that yields between seasons are not perfectly correlated, this will tend to reduce risks by, for example, lowering the coefficient of variation of annual yields, even though as we have discussed elsewhere (Alauddin and Tisdell, 1987; see also Boyce, 1987a) production sustainability problems may emerge in the long term. Multiple cropping is likely to reduce the probability of annual farm income falling below a disaster level, if we leave the secular problem to one side (Anderson et al., 1977, p.211).

While HYVs may have a higher expected yield and greater risk or yield variability than traditional varieties, in some cases HYVs may