AREA AND DIVERSITY OF A CROP REFLECTS THE DIVERSITY OF OTHERS

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ABSTRACT

This study was carried out to relate the diversity of one crop in terms of number of landraces and farm area with the diversity of other crop. Information collected during baseline survey of in-situ global project (1999) on three crops namely rice, finger millet and sponge gourd in Jumla, Kaski and Bara of Nepal were used. Farm area of each variety and number of landraces grown by sampled household were used for F-test, regression and chi-square analyses to test the diversity of one crop with respect to other. Households having large number of landraces of finger millet maintained large number of rice landraces. Households maintaining different landraces of sponge gourd and finger millet showed a relation with their farm area allotted to rice landraces. Households having large area for rice cultivation maintained a large number of rice landraces in all the sites. The analyses showed that the farmers growing diversity in one crop are more likely to grow diversity in other crops. Similarly, if area in a household allotted to a particular crop species is large, there is chance of growing high diversity of the crop species. Households having large farm size and maintaining high diversity of a crop species may be target farmers for genetic resources management.

Key words: Correlated diversity, finger millet, rice, sponge gourd

INTRODUCTION

Farmers generally grow more than one variety and more than one crop species in their farm. Many factors play determinant roles in maintaining variety and species diversity at farm level (Cromwell and van Oosterhout, 2000). Knowledge on relationship of farm size to varietal richness is useful for land reform planning. Similarly, information on diversity of one crop with respect to diversity of other crops would also be useful for research and development program. Such information can be used to predict crop varieties and species diversity maintained by households based on their categories. The study was done to draw information in the aspects taking reference of rice, finger millet and sponge gourd in the three agroecological regions.

MATERIALS AND METHODS

Information collected during baseline survey of in-situ global project 1999 on three crops rice, finger millet and sponge gourd from Jumla, Kaski and Bara were used (Rana et al., 2000a; 2000b; 2000c). Farm area of each variety grown by sampled household was the basis of analysis. Household growing only modern varieties or without any rice variety was excluded. Households growing finger millet and sponge gourd were categorized as household with zero landrace, household with one landrace and household with more than one landrace. These categories are treated as treatments and observations were quantitative in nature (e.g. area of each landraces and number of landraces in each household). Based on these categories and because of structural treatment, analysis of variance (ANOVA) was applied for testing whether these categories had significantly maintained different number of rice varieties.

These categories were also related to farm area allotted to rice using ANOVA. With area and number of rice varieties in each sampled household, ANOVA was used to test whether

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the farm area allotted to rice had relationship with number of varieties. Regression approach was also applied to test this relationship.

Chi-square was used to test the hypothesis, 'diversity in different crop species maintained by households is independent'. Sample households from Kaski and Bara belonged to all categories, the households with zero variety, with one variety and with more than one variety. Independency of these categories was tested for rice growers with finger millet growers and sponge gourd growers separately.

RESULTS

F-TEST

Three categories of households i.e. HHs with zero landrace, HHs with one landrace and HHs with more than one landrace of finger millet were significantly different for number of rice landraces maintained by these categories in Jumla (Table 1). Highly significant results were also found in Kaski and Bara. HHs having a large number of landraces of finger millet also maintained a large number of rice landraces. There were highly significant differences among these three categories of HHs for sponge gourd with relation to rice richness in a household of Kaski. However, the difference in number of rice landraces maintained among HHs maintaining different sponge gourd landraces was not significant in Bara (Table 2).

Table 1. Analysis of variance for HHs with different number of rice landraces

Source	Jumla			Kaski			Bara		
	df	MS	P	Df	MS	P	df	MS	P
Between HHs maintaining different finger millet landraces	3	0.26	0.03	5	111.3	<0.001	2	33.77	<0.001
Residual	176	0.08		156	5.55		83	3.50	

Table 2. Analysis of variance for HHs with different number of rice landraces

Source	Kaski			Bara		
	df	MS	P	df	MS	P
Between HHs maintaining different sponge gourd landraces	3	69.03	<0.001	2	7.27	0.17
Residual	158	7.69		83	4.13	

HHs maintaining different landraces of sponge gourd and finger millet was related with their farm area allotted to rice landraces. In Kaski, significant pattern was observed between number of finger millet landraces maintained in HHs and farm area alloted to rice by these HHs (Table 3). Similar result was found among HHs maintaining different number of landraces of sponge gourd with farm area of rice (Table 4). Farm area of rice did not significantly reflect any evidence of landrace richness of finger millet and sponge gourd in Jumla and Bara.

Table 3. Analysis of variance of farm area allotted to rice by households

Source	Jumla			Kaski			Bara		
	df	MS	P	df	MS	P	df	MS	P
Between HHs maintaining different finger millet landraces	3	2.33	0.51	5	143.4	0.005	2	670	0.41
Residual	176	3.04		156	41.3		83	762	

The hypothesis, 'HHs having large area for rice cultivation maintained a large number of rice landraces was tested. Three categories of HHs i.e. HHs with 0-landrace, HHs with 1-landrace and HHs with >1-landrace of rice have significantly different farm area alloted to rice in all three sites, Jumla, Kaski and Bara (Table 5). HHs having more area for rice cultivation have maintained more number of landraces of rice in all three sites.

Table 4. Analysis of variance of farm area allotted to rice by households

Source	Kaski			Bara		
	df	MS	P	df	MS	P
Between HHs maintaining different sponge gourd landraces	3	281.2	<0.001	2	565	0.48
Residual	158	39.9		83	764	

CHI-SQUARE TEST

Independency of three categories i.e. HHs with zero landrace, HHs with one landrace and HHs with more than one landrace in case of rice, finger millet and sponge gourd was tested using chi-square. The number of HHs growing zero, one and more than one finger millet landrace were dependent on number of rice landraces grown by the HHs in Kaski and Bara (Table 6). In Kaski, significant effect of number of rice landraces was observed on maintenance of sponge gourd landraces.

Table 5. Analysis of variance of farm area alloted to rice by households

Source	Jumla			Kaski			Bara		
	df	MS	P	Df	MS	P	df	MS	P
Between HHs maintaining different rice landraces	1	31.02	0.001	11	272.17	<0.001	7	3133.2	<0.001
Residual	177	2.87		147	22.95		76	525.58	

Table 6. χ^2 value for no. of HHs growing 0, 1 and >1 landraces in different crop species

	Number of HHs growing zero, one and > one finger millet landraces		Number of HHs growing zero, one and > one sponge gourd landraces	
	Kaski	Bara	Kaski	Bara
Number of HHs growing zero, one and > one rice landraces	22.44 P = <0.001	6.72 P = 0.05	22.29 P = <0.001	6.3 P = 0.05

REGRESSION APPROACH

Results of variety richness regressed on farm area allotted to rice by HHs are given in Table 7. The variance accounted by regression was highly significant in the three sites. Regression coefficients were also highly significant in all the sites. It indicated that as the area of a farm increased, the number of landraces maintained by the HH increased.

Table 7. Regression outputs considering rice varietal richness as dependent and farm area allotted to rice as independent variables

Source	Jumla			Kaski			Bara		
	df	MS	P for F value	df	MS	P for F value	df	MS	P for F value
Regression	1	0.95	0.001	1	617.62	<0.001	1	95.96	<0.001
Error	178	0.09		160	5.03		84	3.11	
Regression equation	Y=1.0 + 0.04X			Y=1.72 + 0.29X			Y=2.56 + 0.038X		
P value (Reg. coeff.)	0.001			<0.001			<0.001		
R^2	0.19			0.31			0.45		
Sample size	180			86			162		

Y= Number of rice varieties, X= Farm area allotted to rice

The rate of increase in number of rice landraces with farm area was the highest in Kaski. Graphically, the pattern is clear in Kaski and Bara (Fig.1). Due to limited number of landraces and farm area, graphically clear pattern was not seen in Jumla. However, regression coefficient was significant.

DISCUSSIONS

Farm area and varietal options are the major factors for the improvement of household economy. Many factors affect local diversity to be maintained by farmers (Peroni and Hanazaki, 2002). Knowledge on factors affecting crop diversity is essential for the management of diversity. The study revealed in all three sites that if farmers have large area for a particular crop, they are likely to maintain a large number of landraces of the crop. Therefore, farm area should not be reduced, and policy should favor increasing farm area for partial contribution to maintaining crop diversity. The case may be more applicable to those areas where microenvironment variation is high. If the land is homogenous, the case may be opposite. This may not be equally applicable to other crops because, use values of crop are also significantly important on maintaining diversity.

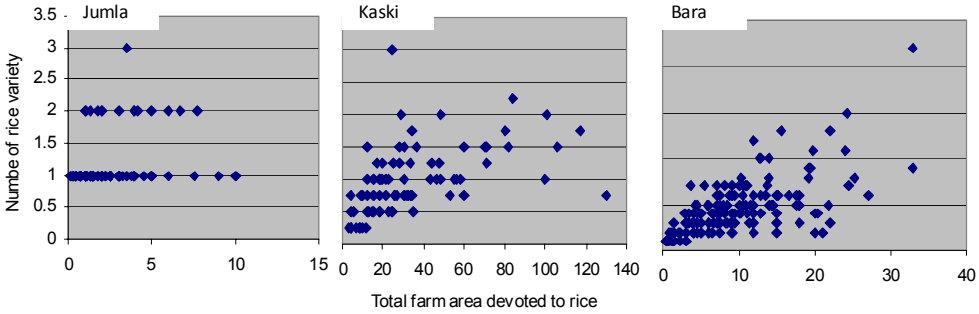

Fig.1: Plotting of farm area allotted to different number of rice landraces by household

Relationship between diversity of one crop to diversity of other crops help in research and development planning and developing biodiversity conservation strategy. In all three sites, diversity of rice landraces at HH levels showed a relation with diversity of finger millet and sponge gourd landraces. It indicated that HHs maintaining a large diversity of a crop is likely to maintain larger diversities of other crops as well. Therefore, for exploration and conservation of genetic diversity, one should consider the households having large number of landraces in any one of the crop species.

CONCLUSIONS

Farmers growing diversity in one crop are more likely to grow diversity in second crop. Similarly, if farm area allotted to a particular crop species is large, there is chance of growing a large number of the crop landraces. Households having large farm size and maintaining more number of crop species and landraces would be target of crop genetic resources management programs.

REFERENCES

Cromwell, E. and S. van Oosterhout, 2000. On-farm conservation of crop diversity: Policy and institutional lessons from Zimbabwe. In: S.B. Brush (ed.), Genes in the field. IDRC and IPGRI, pp. 217-238.

Peroni, N. and N. Hanazaki, 2002. Current and lost diversity of cultivated varieties, especially cassava, under swidden cultivation systems in the Brazilian Atlantic Forest. Agriculture, Ecosystems and Environment, 92:171-183.

Rana, R.B., D.K. Rijal, D. Gauchan, B.R. Sthapit, A. Subedi, M.P. Upadhyay, Y.R. Pandey and D.I. Jarvis, 2000a. In-situ crop conservation: Findings of agro-ecological, crop diversity and socio-economic baseline survey of Begnas ecosite, Kaski, Nepal. NP Working Paper No 2/2000. NARC, LIBIRD and IPGRI.

Rana, R.B., P. Chaudhary, D. Gauchan, S.P. Khatiwada, B.R. Sthapit, A. Subedi, M.P. Upadhyay and D.I. Jarvis, 2000b. In-situ crop conservation: Findings of agro-ecological, crop diversity and socio-economic baseline survey of Kachorwa ecosite, Bara, Nepal. NP Working Paper No 1/2000. NARC, LIBIRD and IPGRI.

Rana, R.B., C.L. Paudyal, P.R. Tiwari, D. Gauchan, A. Subedi, B.R. Sthapit, M.P. Upadhyay and D.I. Jarvis, 2000c. In-situ crop conservation: Findings of agro-ecological, crop diversity and socio-economic baseline survey of Talium ecosite, Jumla, Nepal. NP working paper no 3/2000. NARC, LIBIRD and IPGRI.