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Intercropping Maize with Cowpeas and Mungbean under Rainfed Conditions

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Abstract: The research study was conducted at two locations i.e. Barani Agricultural Research station (Kohat) and Barani Seed Farm (Hangul to ascertain the biological efficient and economic efficient intercropping system of maize with cowpeas and mungbean. The studies consisted of five intercropping systems (maize sole, cowpeas sole, mungbean sole, maize + cowpeas and maize + mungbean). The results regarding LER showed that maize + cowpeas intercrop average of two locations was 1.29 indicating 29 percent yield advantage which is also biological efficient system. The maize + mungbean indicating 4 percent yield advantage. However, the economic analysis gave a different results which showed that mungbean sole crop gain highest BCR value (return per rupee invested i.e. Rs. 4.82) followed by cowpeas sole crop (Rs. 4.13). It is concluded that apart from biological efficient different economic indices should be computed for comparison and final recommendation for wide spread adoption.

Key words: Intercropping, maize, cowpeas, mungbean, biological and economical efficient

Introduction

Intercropping (growing one or more crops simultaneously on the same field) is one of the way of ameliorating the productivity of land and other inputs (Andrews and Kassam, 1976). Intercropping is used by small farmers primarily to increase the diversity of their products and the stability of their annual output through effective use of land and other resources (Frankis and Sanders, 1978). Enyi (1973) reported that small farmers in many countries are seriously constrained by low productivity and limited land resources. Therefore, preliminary research has shown that possible means of increasing the productivity on these farms would be through intercropping. Willey and Osiru (1972) recommended that intercropping of maize with legumes appears to be more profitable. The economic returns can be greater if relatively higher value legumes suitable for intercropping are chosen. In many tropical countries the intercropping of cereal-legumes mixture is practiced to mae effective use of land and other resources. Since this subject has not been thoroughly studied in the drier/rainfed areas of Kohat division where rain fall is erratic and low, thus in the preset study an attempt was made in the direction to explore the biological efficient/economical efficient intercropping/mono-cropping system under agro-ecological conditions of Kohat.

Materials and Methods

A field experiment was conducted at two diverse agro-ecological zone of Kohat division during the year 1998 Kharif (monsoon season).

Detail of Locations

1. Barani Agril. Res. Station Jarma, Kohat where rainfall ranged from 10" to 20" annually. The crop at this location was irrigated once when there was a drought spell in first week of September.
2. Barani Extension seed Farm Hangu where rainfall ranged from 15" to 30" annually.

The experiments comprised with the following treatments:

1. Maize sole crop
2. Cowpeas sole crop
3. Mungbean sole crop
4. Maize + Cowpeas intercrop alternate row
5. Maize + Mungbean intercrop alternate row

The treatments were replicated four times in Randomized complete block design using a net plot sizes of 3.6 x 5 m with row to row distance of 60 cm. The crop was sown with single row cotton drill with manual labor. Recommended seed rate and fertilizer dose were used for all the treatments. The rest of the agronomic practices were also normal and uniform. All the three crops weather sole or intercroped were harvested manually at their respective physiological maturities and the grain yield data were recorded from the four central rows and then converted into kg/ha. Land Equivalent Ratio was calculated for biological efficiency as follow:

LER is the land required for sole crops to produce the yield achieved in the intercropping mixture. This provides measure of the efficiency of particular crop association relative to the sole crop (Willey, 1979) and is the most important index of measuring biological advantage of intercropping as compared to corresponding monocroping system.

The index is based on relating the yield of each crop in an intercrop mixture to the yield of that crop grown as a sole crop and then sum up the resulting ratios to give the combine index.

LER can be calculated as:

$$LER = \frac{YI^1}{YS^1} + \frac{YI^2}{YS^2}$$

Where

YI^1 = Yield of first crop (maize) in the intercropping system
YS^1 = Yield of first crop (maize) in sole cropping system
YI^2 = Yield of 2nd crop (cowpeas/mungbean) in the intercrooping system

YS^2 = Yield of 2nd crop (cowpeas/mungbean) in the sole' cropping system.

The interpretation embodies that a value of the intercropping system which is greater than one (1) is indicting an over all biological advantage of intercropping over the sole crops. Economic indices i.e. Gross income, cost of cultivation and Net income were calculated for computing BCR value (return per rupee invested as follow:

$$\text{Return per rupee invested} = \frac{\text{Gross return}}{\text{Total (variable) cost of cultivation}}$$

Results and Discussion

Land equivalent ration (LER): Cowpeas and mungbean were tested for the suitability as intercrops in maize in the rainfed condition of Kohat, The important criterion was not to sacrifice the yield of maize but at the same time to get some additional yield from the intercrop. Among the intercrop tested at Barani Agril. Res. Station Kohat and Barani Seed Farm (Hangu), cowpeas was found to be the most suited intercrop in maize (Table 1).

Table 1: Yield and LER values of maize and intercrops

Treatments	Yield kg/ha Barani Agric. Res. Station Kohat			Yield kg ha^{-1} Barani Seed Farm Hangu			Average Yield kg ha^{-1} of locations		
	Maize sole	Inter crop	LER	Maize	Inter sole	LER crop	Maize sole	Inter crop	LER
Maize sole	1692	-	1	800	-	1	1246	-	1
Cowpeas sole	617	-	1	450	-	1	534	-	1
Mungbean sole	871	-	1	600	-	1	736	-	1
Maize + cowpeas	1140	373	1.28	505	300	1.30	823	337	1.29
Maize + mungbean	988	438	1.09	315	360	0.99	652	399	1.04

Table 2: Economic analysis of intercropping maize with cowpeas and mungbean average cross two locations

Intercropping system/ Treatments	Average Yield of locations kg/ha	Gross income (Rs./ha)	Cost of cultivation (Rs./ha)	Net income (Rs./ha)	Returned per rupee (Rs.)
Maize sole	1246	7476	2800	4676	2.67
Cowpea sole	534	12816	3100	9716	4.13
Mungbeanzsole	736	13248	2750	10498	4.82
Maize + cowpea	823 + 337 =1160	13026	3320	9706	3.92
Maize + mungbean	652+399=1051	11092	2970	8122	3.73

Maize price per kg = Rs.6/-, Cowpeas price per kg = Rs. 24/-, Mungbean price per kg = Rs. 18/-

where the LER values are 1.28 and 1.30 respectively. Cowpeas being climbing type and crop mature earlier than maize and did not complete with maize much. Those results are in close conformity with Singh (1981). Calculation of LER showed that cowpea is compatible intercrop for maize in Kohat and Hangu areas. The data regarding LER of maize intercrop with cowpeas average of two locations was 1.29 indicating 29 percent yield advantage from intercropping of cowpeas in both the location. It clearly indicated that the productive/biological efficiency of cowpea was higher in intercropping system which was probably attributed to better utilization of growth factors. These findings are in accordance with those of De *et al.* (1978). Mungbean complete with maize upto some extent and reduction in LER value of 0.99 at Hangu might he attributed to this factor. However, at Kohat it showed 9 percent yield advantage over the sole system which is comparatively lower yield gain.

Comparison of economic indices based on yield: Agro-economic feasibility of an intercropping system is ultimately determined by its not monetary gain. No single index is capable of giving a good comparison of intercropping system and so a number of indices are used together to assess the economic viability of the system. The agronomist decides on the biological efficient while the economist decides on the economic worthiness of the system using one or more of the economic indices. In general, a biologically efficient system is also economically superior but quite often it so happens that a biologically efficient system is not economically viable and cannot be recommended for wide scale adoption by farmers.

An estimate of the economic aspect of the present studies were computed and the data regarding the monetary gain alongwith all relevant calculations and interpretation average of the two locations are presented in (Table 2). In a intercropping system experiment for rainfed area of Kohat and Hangu, it was observed that maize + cowpea and maize + mungbean are biologically efficient and were better than sole cropping having LER values of 1.29 and 1.04 (Table 1) respectively. But economic analysis (Table 2) gave a different result where sole crop of mungbean gave the highest gross returns (Rs. 13248), net returns (Rs. 10498) and return per rupee invested (Rs. 4.82). Next in order was cowpea sole crop which gave gross return (Rs. 12816), net returns (Rs. 9716) and return per rupee invested (Rs. 4.131. This is because both the crops i.e. mungbean and cowpea are leguminous crops and tolerant to drought as compared to maize sole and intercrop involved maize. These results are in close confirmation with the finding of Elangovan (1980), Singh (1995) and Enyi (1973). De *et al*. (1978) further indicated that the productive efficient of both the legumes crops sown alone were higher which was probably attributed to better utilization of growth factors as compared to intercropping with maize. Those findings are also in accordance with the present achievements. Maize price per kg = Rs. 61-, Cowpeas price per kg = Rs. 24-, Mungean price per kg = Rs. 18.

It is concluded from the preset findings that an evaluating intercropping system for an area, apart from biological efficient, different economic indices should be computed and objectively compared before deciding on the worthiness of a message for further on-farm testing and wide scale adoption.

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References

Andrews, D.J. and A.H. Kassam, 1976. The importance of multiple cropping in increasing world food supplies in multiple cropping. Am. Soc. Agron., 27: 1-10.

De, R., R.S. Gupta, S.P. Singh, M. Pal, S.N. Singh, R.N. Sharma and S.K. Kaushik, 1978. Interplanting maize sorghum and peas millet with short duration grain legumes. Ind. J. Agric. Sci., 48: 132-137.

Elangovan, 1980. Studies on cropping system for rainfed black soil areas in North East monsoon season. M.Sc. Thesis, Tamil Nadu Agricultural University, Coimbatore, India.

Enyi, B.A.C., 1973. Effects of intercropping maize or sorghum with cowpeas, pigeon peas or beans. Exp. Agric., 9: 83-90.

Frankis, C.A. and J.H. Sanders, 1978. Economic analysis of bean and maize systems: Monoculture versus associated cropping. Field Crops Res., 1: 319-325.

Singh, R.P., 1981. Small farmers and landlessness in South Asia. The World Bank, Washington, DC.

Singh, R.P., 1995. Efficient Crop and Cropping System for Dryland in India. In: Sustainable Development of Dryland Agriculture in India, Singh, R.P. (Ed.). Scientific Publishers, Jodhpur, pp: 271-283.

Willey, R.W. and D.S. Osiru, 1972. Studies on mixture of maize and beans (*Phaseolus vulgaris*) with particular reference to plant population. J. Agric. Sci., 79: 519-529.

Willey, R.W., 1979. Intercropping: Its importance and research needs. Part 2. Agronomy and research approaches. Field Crop Abstr., 32: 73-85.