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Assessment of yield in KVK programme: A multivariate approach

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ABSTRACT

Food security is now recognized globally as one of the important concerns. Availability along with the price tag of food item is a point of debate all over the world. Enhancement of productivity through KVK activities, have been examined in the present study and considered to be one of the great achievement of the programme besides other mandates. More and more villages are to be adopted by the institution to ensure food security; nutritional security can also be maintained by the diversification of the agriculture.

***Key words*:** Clubbing of variables (factor analysis), correlation co-efficient, multiple regression

One of the main tasks of the KVK is to provide an improved level knowledge to the beneficiaries about the latest farm practices. Once knowledge is acquired and retained that would leads to higher adoption, which in turn will bring more profit and strengthen the farm economy in the country as a whole (Sharma, 2002). Keeping in view the above mention fact, the study was undertaken with the objective to assess and analyze the yield of the crops between KVK adopted (Cooch Behar KVK) and non-adopted respondents and to select and assess the variables in the form of antecedent variables (personal and socio economic) and consequent variables like yield of the crops.

MATERIALS AND METHODS

Since KVK run programmes have been introduced in the Pundibari village under Cooch Behar II, the same village was chosen as a purposive selection to comply with the objective of evaluating extent of adoption by the KVK and non KVK farming categories.

The data base was generated with the help of personal and interview method. Respondent selection in the village followed the techniques of simple random sampling. 32 respondents from 78 adopted KVK farmers and other 32 respondents from 90 non-adopted KVK farmers have been identified randomly for this study. The collected data were processed into the statistical tools like coefficient of correlation, multiple regression analysis and clubbing of variables (factor analysis) for drawing conclusion for the present study.

RESULTS AND DISCUSSION

Correlation coefficient between the yield of the crops (Y), and other 20 antecedent variables have been done. Table 1 reveals that among all the crops, groundnut is positively correlated with Age (X_1) and rice, jute and potato is positively correlated with primary occupation (X_3), management orientation (X_{17}) and production orientation (X_{19}) for KVK adopted respondents.

Similarly rice, jute and mustard found to be significantly associated with the house type (X_9) and market orientation (X_{20}). Whereas, land holding (X_8) and farm power (X_{10}) is positively correlated with rice and jute cultivation but secondary occupation (X_4) set up a negative correlation with this crop. Mass media exposure X_{13}), No. of training received from KVK (X_{15}) and no. of days of training received from KVK (X_{16}) are positively but caste (X_2) is negatively correlated with mustard cultivation.

The variables namely asset possession (X_{11}) positively signifies the cultivation of crops like potato and elephant foot yam but negatively correlated with the turmeric cultivation.

On the other hand, outside communication (X_{14}) is positively correlated with maize and tobacco cultivation. Lastly planning orientation (X_{18}) positively signifies the cultivation of rice crops and contact with extension personnel or organization (X_{12}) positively signifies the jute cultivation.

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Table 1: Correlation coefficient between independent variables for KVK adopted respondents and the yield of the crops

Variable	Correlation coefficients										
	Yield (Y)										
	Rice	**Jute**	**Potato**	**Mustard**	**Wheat**	**Lentil**	**Ground nut**	**Maize**	**Tobacco**	**Elephant foot yam**	**Turmeric**
X1	0.094	-0.001	0.249	-0.056	0.190	0.039	0.803*	0.270	0.636	-0.678	0.918
X2	0.178	-0.144	-0.039	-0.465*	0.104	-0.618	0.456	-0.170	0.500	0.690	-0.098
X3	0.580**	0.709**	0.527**	0.293	0.000	0.570	-0.166	0.036	0.000	0.000	0.000
X4	-0.550**	-0.577**	-0.150	0.044	-0.431	-0.725	0.290	-0.420	0.500	0.000	0.000
X5	0.064	0.168	-0.201	0.292	0.116	-0.278	-0.451	0.602	0.000	0.000	-0.039
X6	0.071	0.017	-0.324	-0.138	0.320	-0.273	-0.043	0.567	0.000	-0.365	0.878
X7	0.025	0.020	0.139	0.313	-0.087	0.000	0.406	0.453	0.000	-0.949	0.169
X8	0.589**	0.479**	0.238	0.136	0.350	-0.209	0.135	-0.175	-0.500	-0.365	-0.845
X9	0.393*	0.432*	0.361	0.507*	-0.234	0.618	-0.051	-0.294	-0.500	-0.671	-0.098
X10	0.371*	0.401*	0.091	0.309	0.508	0.618	0.000	0.447	-0.500	-0.365	-0.878
X11	0.211	0.344	0.454*	0.372	0.037	-114.000	-0.063	-0.739	-0.397	0.953*	-0.996**
X12	0.274	0.487**	0.079	0.426	0.210	0.728	0.151	0.170	0.500	-0.919	-0.663
X13	0.129	0.287	-0.091	0.468*	0.134	-0.070	0.424	0.251	0.500	-0.928	-0.258
X14	0.330	-0.039	-0.248	0.058	0.036	-0.235	-0.507	0.870*	1.000**	-0.516	0.627
X15	0.089	0.068	0.053	0.621**	0.202	0.078	-0.464	-0.521	0.866	-0.224	0.077
X16	0.051	0.054	0.076	0.65**	0.026	-0.088	-0.430	-0.468	0.866	-0.165	0.012
X17	0.601**	0.641**	0.415*	0.427	0.237	0.756	-0.353	0.385	0.866	0.365	0.418
X18	0.513**	0.348	0.049	0.279	0.030	0.681	-0.550	0.701	0.866	-0.675	0.732
X19	0.528**	0.578**	0.524**	0.285	-0.087	0.672	-0.556	0.253	-0.655	0.695	0.098
X20	0.430*	0.569**	0.275	0.467*	0.498	0.600	0.113	0.198	0.500	0.894	-0.180

*Note: *, **Significant at 5% and 1% level of significance, respectively*

Description of the variables

Age (X_1)	Family Type (X_6)	Asset Possession (X_{11})	No. of days of training received from KVK (X_{16})
Caste (X_2)	Family Type (X_7)	Contact with Extension Personnel or Organization (X_{12})	Management orientation (X_{17})
Primary occupation (X_3)	Land Holding (X_8)	Mass media Exposure (X_{13})	Planning orientation (X_{18})
Primary occupation (X_4)	House Type (X_9)	Outside communication (X_{14})	Production orientation (X_{19})
Education(X_5)	Farm Power (X_{10})	No. of training received from KVK (X_{15})	Market orientation (X_{20})

Correlation coefficient between the yield of the crops (Y) and other 20 antecedent variables have been done. Table 2 reveals that among all the crops potato is positively correlated with family type (X_6) whereas land holding (X_8) is negatively correlated with tobacco cultivation for non adopted beneficiaries. Similarly on the groundnut found to be significantly associated with the outside communication (X_{14}), management orientation (X_{17}) and market orientation (X_{20}).

Table 2: Correlation coefficient between the independent variables for non adopted respondents and yield of the crops

Variables	Correlation coefficient										
	Yield (Y)										
	Rice	Jute	Potato	Mustard	Wheat	Lentil	Ground nut	Maize	Tobacco	Elephant foot yam	Turmeric
X1	-0.001	-0.329	0.143	0.263	-0.145	-0.027	-0.245	-0.277	-0.788	0.567	-0.381
X2	-0.162	0.097	-0.294	0.203	0.168	-0.249	-0.179	0.022	0.455	0.119	-0.054
X3	0.093	0.088	0.056	0.149	0.145	0.040	0.591	-0.328	0.000	0.000	-0.215
X4	-0.060	-0.207	0.186	-0.130	-0.115	-0.040	-0.150	-0.138	0.000	0.000	0.104
X5	0.305	0.077	0.157	0.172	0.084	0.071	0.416	0.296	0.488	-0.320	0.074
X6	0.261	-0.194	**0.469***	0.095	-0.154	-0.328	-0.299	-0.296	0.110	0.339	0.276
X7	-0.062	0.056	0.412	0.077	0.117	-0.249	-0.676	0.063	0.658	0.000	0.590
X8	-0.005	-0.030	-0.112	0.228	-0.202	-0.054	0.135	0.367	**-0.993****	-0.359	-0.444
X9	-0.237	-0.253	-0.108	-0.087	-0.381	-0.157	0.468	-0.054	0.000	0.801	-0.654
X10	0.160	0.051	0.071	0.194	-0.337	0.063	-0.255	0.327	-0.488	-0.359	-0.042
X11	-0.073	-0.204	0.091	0.092	0.184	0.014	0.369	0.145	-0.658	0.202	0.005
X12	0.087	-0.198	0.156	0.067	0.124	0.289	-0.070	0.118	-0.889	0.298	-0.185
X13	0.266	0.187	0.045	0.159	0.186	0.098	0.496	0.364	-0.571	-0.729	0.123
X14	0.023	-0.053	0.105	0.044	-0.138	-0.222	**0.795***	-0.010	-0.488	-0.468	-0.346
X15	-0.107	-0.153	0.356	0.057	-0.122	-0.221	-0.095	0.051	-0.488	-0.555	0.027
X16	-0.092	-0.099	0.363	0.120	-0.088	-0.157	-0.287	-0.019	-0.488	-0.555	0.209
X17	0.011	-0.110	0.091	0.373	0.203	-0.330	**0.806***	-0.283	0.228	0.187	-0.471
X18	0.045	0.101	0.196	0.052	-0.156	-0.463	0.212	0.061	0.429	0.324	-0.307
X19	-0.165	-0.250	0.140	0.410	0.178	-0.257	0.722	-0.501	-0.481	0.849	0.503
X20	0.116	-0.099	-0.100	0.414	0.341	-0.122	**0.868***	-0.150	0.340	-0.577	-0.212

*Note: *, **Significant at 5% and 1% level of significance, respectively*

Description of the variables

Age (X_1)	Family Type (X_6)	Asset Possession (X_{11})	No. of days of training received from KVK (X_{16})
Caste (X_2)	Family Type (X_7)	Contact with Extension Personnel or Organization (X_{12})	Management orientation (X_{17})
Primary occupation (X_3)	Land Holding (X_8)	Mass media Exposure (X_{13})	Planning orientation (X_{18})
Primary occupation (X_4)	House Type (X_9)	Outside communication (X_{14})	Production orientation (X_{19})
Education(X_5)	Farm Power (X_{10})	No. of training received from KVK (X_{15})	Market orientation (X_{20})

Table 3 revealed coefficient explained the yield of the crops (Y) with the help of causal variables. Among all the crop yield of the rice and jute is explained by management orientation (X_{17}) variables with its positive contribution towards enhancing yield of the rice and jute. Total variance explained by such equation is 21% and 18% respectively and all predictor in this equation have resulted highly significant regression coefficient to explain yield of the crops (Y).

On the other hand impact on yield of the potato is explained by family size (X_7), No. of training received from KVK (X_{15}) and production orientation (X_{19}) variables (Subhangi Bonde *et al*., 2002) with their positive contribution towards enhancing Y and contact with extension personnel or organization (X_{12}) with its negative impact forwards reducing the magnitude of Y total variance explained by such equation is 69% and all predictor in this equation have resulted highly significant regression coefficient to explain the yield of the crops (Y) namely potato in the same table.

Table 3: Best fitted regression equation following stepwise model of multiple regression equation

Dependent variables	Equation	R^2	Adj. R^2	SE (Est.)	Relative importance has been done according to standardized value of β coefficient
Rice	Rice = 0.68 + 0.089 X_{17}	0.21	0.20	1.07	
Jute	Jute = 0.57 + 0.068 X_{17}	0.18	0.17	0.89	
Potato	Potato = 7.65+1.34 X_{19} + 1.15 X_{15} – 0.73X_{12} + 2.71X_7	0.69	0.66	3.98	X_7>X_{19}>X_{15}>X_{12}
Mustard	Mustard = 0.52 + 0.074 X_{16} + 0.053 X_{19}	0.45	0.42	0.41	X_{16} > X_{19}
Wheat	Wheat = -0.11 + 0.099 X_{17} – 0.48X_9	0.50	0.46	0.57	X_{17} > X_9
Maize	Maize = 4.35 + 0.57 X_5	0.32	0.26	1.24	
Tobacco	Tobacco = 3.43-1.30 X_8 + 1.57 X_9 + 0.17 X_{15} – 0.05 X_{12}	0.99	0.99	0.014	X_9>X_{15}>X_8>X_{12}
Elephant foot yam	Elephant foot yam = 17.86 + 4.44 X_{19} – 2.73 X_{18}	0.94	0.91	4.03	X_{19} > X_{18}

Impact on yield of the mustard to explained by the no. of days of training received (X_{16}) and production orientation (X_{19}) variables with their positive contribution towards enhancing Y. Total variance explained by such equation is 45% and all predictor in this equation have resulted highly significant regression coefficient to explain the yield of the crops (Y) namely mustard in the same table.

The coefficient cited in table 3 explained the yield of the crops (Y), namely wheat, with the help of causal variables. Among all the crop yield of the wheat is explained by management orientation (X_{17}) through their positive contribution towards enhancing yield. house type (X_9) with its negative impacts forwards reducing the magnitude of Y total variance explained by such equation is 50 percent and all predictor in this equation have resulted highly significant regression coefficient to explain the yield of the crops (Y) namely wheat.

The resultant coefficient explained the yield of the crops (Y), namely maize, with the help of causal variables. Among all the crop yield of the maize is explained by education (X_5) variable with its positive contribution towards enhancing yield of the maize. Total variance explained by such equation is 32 percent and all predictor in this equation have gone with highly significant regression coefficient to explain yield of the crops (Y) namely maize.

The Yield of the crops (Y) namely tobacco, (Table 3) is explained by House Type (X_9) and Number of training received from KVK (X_{15}) variables with their positive contribution towards enhancing Y and Land Holding (X_8) and Contact with Extension Personnel or Organization (X_{12}) with its negative impacts caused reducing the magnitude of Y. Total variance explained by such equation is 99 percent and all predictor in this equation have resulted highly significant regression coefficient to explain yield of the crops (Y) namely tobacco.

We found that the resultant coefficient explained the yield of the crops (Y) namely elephant food yam with the help of causal variables (Table 3). Among all, the crop yield of the elephant food yam is explained by production orientation (X_{19}) variable with their positive contribution towards enhancing yield and planning orientation (X_{18}) with its negative impacts contributes to reducing the magnitude of yield. Total variance explained by such equation is 94 percent and all predictor in this equation have resulted highly significant regression coefficient to explain the yield of the crops (Y) namely elephant food yam.

The yield of turmeric (Y) has positively impacted by the variables, land holding (X_8) and family size (X_7). Whereas age (X_1), caste (X_2), contact with extension personnel or organization (X_{12}) and market orientation (X_{20}) with its negative impacts forwards reducing the magnitude of Y (Table 3). Total variance explained by such equation is 98% and all predictor in this equation have resulted highly significant regression coefficient to explain yield of the crops (Y) namely turmeric.

Table 4: Best fitted regression equation following backward multiple regression method

Dependent variables	Equation	R^2	Adj. R^2	SE (Est.)	Ranking of importance of independent regression
Turmeric	Turmeric yield = 19.50 – 0.02 X_1 – 0.44 X_2 + 2.40 X_7 + 1.01 X_8 – 1.80 X_{12} – 0.19 X_{20}	0.98	0.96	0.27	$X_{12}>X_7>X_2>X_8>X_{20}> X_1$
Groundnut	Groundnut yield = -8.46 + 0.07 x_1 + 0.15 X_2 – 0.61 X_6 – 1.75 X_8 + 0.21 X_{13} + 0.20 X_{17}	0.95	0.90	0.25	$X_8>X_{17}>X_1>X_{13}>X_6> X_2$
Lentil	Lentil yield = 48.82 – 0.07 X_1 + 2.49 X_2 – 3.28 X_3 – 2.45 X_4 + 1.17 X_5 – 3.38 X_6- 0.51 X_8 + 0.52 X_9 – 0.38 X_{10}-0.54 X_{11} + 0.48 X_{12} – 1.15 X_{13} – 1.57 X_{14} + 0.13 X_{16} + 0.27 X_{20} – 0.43 X_{17}	0.99	0.99	0.02	$X_4>X_3>X_2>X_{13}>X_{17}>$ $X_{14}>X_5>X_6>X_{11}>X_{12}>X_1>X_{20}>X_{16}>X_{10}>$ $X_9>X_8$

Yield of the crops (Y) substantiates positive contribution towards enhancing yield of product. The other two variables, family type (X_6) and land holding (X_8) through there negative impact have reducing the magnitude of yield. Total variance explained by such equation is 95 percent. This would imply that with the combination of these variables 95 percent variance is yield has been predicted.

Yield of the crop (Y) namely lentil is explained by castes (X_2), education (X_5), house type (X_9), contact with extension personnel or organization (X_{12}), total no. of days of training received (X_{16}) and market orientation (X_{20}) variables with their positive contribution towards enhancing Y and age (X_1), primary occupation (X_3), secondary occupation (X_4), family type (X_6), land holding (X_8), farm power (X_{10}), asset possession (X_{11}), mass media exposure (X_{13}), outside communication (X_{14}), management orientation (X_{17}) with its negative impacts forwards reducing the magnitude of Y. Total variance explained by such equation is 99% and all predictor in this equation have resulted highly significant regression coefficient to explain yield of the crops (Y) namely lentil. And according to the beta standardized coefficient value these antecedent variables are arranged in descending order to show the relative importance of the independent variables over the dependent variables.

Table 5: Mean comparison of varying dependent variables between KVK versus non-KVK adopted respondents

Dependent variables	KVK adopted	KVK non-adopted	t	Sig.
Rice	5.48	4.58	-3.229	0.002*
Jute	4.29	3.51	-3.463	0.001*
Potato	37.25	25.55	-10.946	0.000**
Mustard	1.99	1.32	-5.057	0.000**
Wheat	4.39	3.35	-4.212	0.000**
Lentil	2.39	2.31	-0.217	0.831NS
Groundnut	3.19	2.07	-3.442	0.005*
Maize	7.55	4.96	-8.243	0.000**
Tobacco	2.47	2.78	0.767	0.498NS
Elephant food yam	70	50.5	-2.847	0.000**
Turmeric	7.13	5.26	-3.277	0.010*

*Note: *, **Significant at 5% and 1% level of significance, respectively, NS -Non-significant*

Table 6: Factor analysis for clubbing of variables into factor based on factor loading for all the respondents

Factor	Variability		Factor loading	Eigen value	Variance (%)	Cumulative (%)	Factor rename
Factor-1	X_{15}	No. of training received from KVK	0.87	5.78	25.11	25.11	Capacity Building
	X_{16}	No. of days training received from KVK	0.84				
	X_{17}	Management Orientation	0.70				
	X_{18}	Planning Orientation	0.70				
	X_{19}	Production Orientation	0.74				
	Y_1	Attitude towards KVK activities	0.90				
	Y_2	Knowledge gained through KVK's activity	0.90				
	Y_3	Exposure towards communication sources of KVK	0.91				
Factor-2	X_9	House Type	0.78	3.03	13.18	38.30	Social Status
	X_{11}	Asset Possession	0.76				
	X_{12}	Contact with Extension Personnel/ Organization	0.72				
	X_{14}	Outside communication	0.53				
Factor-3	X_3	Primary occupation	0.73	3.03	13.18	51.48	Resource economy
	X_4	Secondary occupation	-0.89				
	X_5	Land Holding	0.64				
	X_{20}	Market orientation	0.59				
Factor-4	X_5	Education	0.85	2.20	9.57	61.05	Family Inter-action
	X_6	Family Type	0.76				
	X_{13}	Mass media Exposure	0.65				
Factor-5	X_1	Age	0.73	1.49	6.46	67.51	Family chronology
	X_7	Family Size	0.76				
Factor-6	X_2	Caste	0.85	1.41	6.13	**73.64**	Modernizing Caste
	X_{10}	Farm Power	0.52				

Factor analysis has been carried out for the static conglomeration of variables based on Eigen roots that is derived from coefficient of correlation. So, a recombination types of agglomeration results which can be trenched as factor. In table 6, the Factor - 1 has accommodated the following variables i.e. X_{15} (no. of training received from KVK), X_{16} (no. of days training received), X_{17} (management orientation), X_{18} (planning orientation), X_{19} (production orientation), Y_1 (attitude towards KVK activities), Y_2 (knowledge gained through KVK's activity), Y_3 (exposure towards communication sources of KVK) and has been renamed as Capacity Building. The factor has contributed 25.11 percent of variance of the predictable character. The analysis is often used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of manifest variables. This is suggestive of the fact that while explaining capacity building only these 8 factors to be considered. The Factor - 2 accommodated the following variables X_9 (house type), X_{11} (asset possession), X_{12} (contact with extension personnel/organization), X_{14} (outside communication) and has been renamed as Social Status contributing variance percentage was 13.18 percent. Similarly, only 4 variables or factors may be considered to explain the social status. The analysis attempts to explains as much as the variance as possible with the least of variance. It has been found that factor-3 has accumulated X_3 (primary occupation), X_4 (secondary occupation), X_8 (land holding), X_{20} (market orientation) and could be renamed as Resource-economy. Here contributing variance percentage was 13.18. That means while explaining the resource economy out of all the variables/factors only those 4 factors to be considered. The factor - 4 has accommodated the following variables X_5 (education), X_6 (family Type), X_{13} (mass media exposure) and has been renamed as Family interaction contributing variance was 9.57 percent. Part of the variance, however is unique to the specific factor and cannot be explained by the component

variables. In this case the family interaction factors are measured by only those 3 factors keeping other factors aside. It has been found that Factor-5 accumulated X_1 (age), X_7 (family Size) and with 6.46 percent cumulative variance and has been renamed as family chronology. Each extracted factors would explain a percentage of total accounted for variance only corresponding to values more than 1 and the highly loaded variables in each factor are only contributing such variability explanation. Uniqueness of this measurement is that the variance that is reflected even in a one or two variables alone. The factor-6 has accommodated the following variables X_2 (caste), X_{10} (farm power) and has been renamed as Modernizing Caste contributing variance was 6.13 percent. Commonality is the part of the variance shared with one or more other variables. Here only 2 factors is sufficient to explain the modernizing caste.

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