Original Article

Technical adoption gap in Udid - A principal component approach

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Abstract

Introduction of sharp-edge optic intraocular lenses (IOL) and the development of the modern phacoemulsification technique have resulted in reduced rates of posterior capsule opacification (PCO). Posterior capsule opacification is the most common complication of cataract surgery and results from the proliferation and migration of residual lenticular epithelial cells. PCO decreases visual acuity and contrast sensitivity leading to disability as a result of glare. Neodymium: yttrium-aluminum-garnet (Nd: YAG) laser capsulotomy has utility in the treatment of PCO. The purpose of this study was to evaluate the influence of size and shape of Neodymium: Yttrium Aluminum Garnet (Nd: YAG) laser capsulotomy on visual acuity and refraction. No significant change in SE following capsulotomy was observed in any group. BCVA significantly improved in all groups following capsulotomy. In conclusion, our study shows that Cruciate shape capsulotomy with an opening of 3.5 mm or less provides the greatest improvement in visual function following Nd: YAG capsulotomy in patients who have had uncomplicated cataract extraction surgery.

Key Words: principal component analysis.

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INTRODUCTION

The general notion is that farmers are not fully exploiting the available technologies and that is why there is large gap between the potential production and actual production. If we compare our agricultural production with the average production of developed countries it is comparatively low. This situation can be changed with the adoption of modern technology. Modern technology plays a key role in increasing agricultural production. Use of high yielding varieties, fertilizers plant protection measures, post harvest technology can help to double the production. The strategy for increased agricultural production adopted by the State government lays major emphasis on intensive farming which necessicitates use of large quantities of new inputs with sufficient technical know hw of the modern technology with a view to achieving higher level of production. Considering the need and availability of pulses, short duration pulse crops udid are selected for the study. Keeping in view the importance of udid production present study has been under taken with following objectives.

AIMS AND OBJECTIVES

1. To study technologies adopted by the farmers in udid production
2. To develop adoption index for udid production.
3. To measure the contribution of each components of technology in udid production.

MATERIAL AND METHODS

The present study is undertakne in Buldana district, data on 46 udid growers for 2015-16 has been taken for the study. Recommended technologies/package of practices for udid production are presented in following table.

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Table 1: Recommended technologies of udid cultivation

Sr. No.	Item	Units	Recommendation
1	Seed rate	Kg/hect	12-15 kg/hect
2	Time of sowing	Date	Last week of June
3	Gap filling	Days	3-5 days after sowing
4	F.Y.M.	Cl/ect	10-12 Cart loads/hect
5	N	Kg/hect	200 kg/hect
6	P	Kg / hect	40 kg/hect
7	Plant protection		Di methoate Phosphumido Malathion, methyl parathion
8	Harvesting	Days	65-70 days after sowing

Practices actually adopted

Adoption of Particular practice = -------------------

Practices Recommended

To find out the gap in adoption level of the technologies of adoption in plant protection measure varies from farmer to farmers. If any plant protection technology is not adopted by the selected then score given is zero and if the technology is adopted the score given is one. The partial score are calculated for partial adoption of technology which were greater than zero and less than one.

Development index by Principal Component Analysis

The main objectives of the principal component analysis are to refer the dimension of a complex multiplicative problem. It is not uncommon if the variations in variables, some of which are closely correlated with one another. In this situation the multiple regression analysis often fails to provide clear and meaningful analysis. The co-effieicient of independent variables become unreliable and sometimes carries wrong signs in this situation. Since these become distorted by the inclusion of other independent variable with which these show a high degree of association. The component analysis on the other hand, takes the correlation matrix into account and produces components which are uncorrelated with one another, to bypass the problem of multi-co linearity. Secondly the component analysis produces components in descending order of their importance that is the first component explains the maximum amount of variation and the last component minimum. It is further found that first 7 or 8 variables account for a sizeable amount of variation of about 75 per cent. It is therefore, possible to represent all variables in terms of Eigen components. Principal components are the linear combinations of random of statistical variable which have special properties in terms of variances. Consider a random vector X of p components covariance matrix Σ. As our interest is in variances and covariance we assume that mean vector is O. Normal distribution of X will give more meaning of principal components. The treatment was include the cases where Σ is positive semi definite (i.e. singular) and where Σ has multiple roots.

A p dimensional vector U with the dispersion matrix Σ. Let λ

1≥ ----λp be the eigen values and P1--Pp be the corresponding eigen vectors of Σ?then.

λ=? λ1 P1P'1+λ2 P'2+ ---- + λp P p P' p ---- (i)

I = P1P?'1+P2P'2+ ---- + Pp P' p

P'1 Σ = λi P'I Σ Pj = 0, i=j ---- (ii)

Consider the transformed random vectors

Yi = P'iu, i=1, ----- P

If Y denotes the vector of the new random vectors and P denotes the orthogonal matrix with P1, P2, --- Pp as its columns, then Y is obtained from U by the orthogonal transformation Y = P. u. The random vector Yi is called ith principal component of U. From (ii) above Some of the properties of Principal components are

(i) The principal components are all uncorrelated. The variance of the ith

Principal component is λi

V (P' iu) = Pi Σ Pi = λi

CoV (P'iU, P'jU) = P'i E Pj = 0 i=j

Thus the linear transformation Y = PU reduces correlated set of variables into an uncorrelated set by an orthogonal transformation.

(ii) Let Gi = λi-1/2 P'iU for λi = 0 and further let r be the rank of Σ so that only the first r eigen values of Σ are non zero.

(iii) Let B be any vector such that 11 B11 = 1. Then V (B'U) is a maximum when. B = P1 and the maximum variance is λi.

Since V (B'U) = B' Σ B, we need the max B'ΣB. Subject to the condition 11 B11 = 1. But the maximum is attained when B = P1.

(iv) The following consequence of the results.

(a) Min V (B'U) = λp = (P'p.U)

11B11 =1. V (B'U) = λi = V (P'iU)

(b) Max

11B11 =1, B [P1---Pi-1]

V (B'U) = λi = V(P'iU)

(c) Min Max

λi-1 11B11=1, BλSi-1

Where Si -1 is a space of (i-1) dimensions in Ep.

(d) Let B1, B2-BK be a set of orthogonal vectors in Ep.

Then λ1+λ2+... ... λk max [V (B'1U) +... + V (B'kU)] B1... Bk.

= V (P' 1U) +... + V (P'kU)

(v) Let B'1 U1... B'k Uk be K Linear functions of U and λ'2i be the residual variance predicting Ui, by the best linear predictor based on

B'1U..... B'kU,

then,

p p
Min E λi
i = 1
B1 ---- BK

Is attending when the set B'1 U1 ---- B'kU is equivalent to P'1U --- B'kU, that is B'iU is a linear combination of the first K principle components. We can without loss of generality replace B'1U----B'kU by an equivalent set of uncorrelated functions and each with variance unity. It is also clear that the functions B'1U---- B'kU should be linearly independent for the optimum solution. The residual variance in predicting Ui on the basis of B'1U---B'kU is λ2 I = λii - [CoV (Ui, B'1U)] 2--- [CoV (Ui-B'kU)]

= λii - (B' 1Σi) 2 ---- B'k Σi Σi' B'k

Where Σi is the ith column of Σ and λii is the variance of Ui

Now,

P p p p
Σ λi2 = Σ λii - B'1(Σi=1 Σi Σi') B1---B'k (Σi=1 Σi Σi') Bk
i=1 i=1

= trace Σ - B'1 ΣΣ B1--- B'k ΣΣ Bk

To minimize Σ λ2 i, we need maximize B'1ΣΣB1+---+B'k ΣΣ Bk

Subject to the conditions

B'i E Bi = 1, Bi1 E Bj=0 i = j

(I.e. B'1U---B'kU are un correlated and each has variance unity.)

The optimum choice of Bi such a case is,

M (B1, B2---Bk) = M (P1, P2 --- Pk)

Where P1, P2--- Pk are the first K Eigen vectors of

l E-λi l = 0

The result in (V) provides an interesting interpretations of the principle components to replace the p dimensional random vector U by K < p linear functions without much loss of information. How is the best K linear function to be chosen? The efficiency of any choice of K linear functions depends on the extent to which the K linear functions enable us to reconstruct the p original variables. One method of reconstructing the variables. Ui is by determining its best linear predictor on the basis of K linear functions, which case the efficiency of prediction, may be measured by the residual variance λ2i. An overall measure of the predictive efficiency is Σλi2. The best choice of the linear functions, for which Σ λi2 is minimum, is the first K principle components of U.

Development of composite index of technology

The components of technology recommended by the University for Different Crops in terms of adoption scores (X1... .. Xn) was utilized for developing composite index of technology adopted. A composite index is a single numerical value representing the net adoption of all components of technologies whose values lies in between 0 and 1. The principal component analysis (PCA) approach was used for developing composite index. PCA based on correlated component was a matrix between kth components of technology computed. A set of Kth components explaining 100% of total variation of all components of recommended technologies was considered correlation matrix where row represents variables and columns represents eigen vectors from which weight (wi) coefficients of components of technology say Σ is determine as,

$$W_i = \frac{M_i}{\Sigma M_i}$$

Where,

Wi = Weight or coefficient of component of technology.

Mi = Maximum element in ith row.

ΣMi = Sum of maximum element in ith row. The required linear function for deriving composite index is,

Si = W1X1 + W2X2 +.... + WnXn

Where,

Si = composite index score.

Xi's = adoption scores for individual component of technology.

This provides adoption index (of all components of technologies) for each cultivator. The composite index obtained in the process lie in between 0 and 1. The composite score of farmers was classified as low level adoption (40-60%) medium level (60-80%) and high level of adoption (above 80%).

RESULTS AND DISCUSSION

The technologies adopted by selected cultivators in udid production according to their level of adoption are presented in Table 2.

Table 2: Technologies adopted by selected udid cultivators

Sr. No.	Technology	Level of adoption		
		Small	Medium	Large
1	Seed Rate	0.93	0.77	0.93
2	Time of sowing	1.00	0.98	0.99
3	N	0.80	0.99	0.90
4	P	0.41	0.72	0.64
5	Plant Protection	0.75	0.38	0.57
6	Harvesting	0.91	0.95	0.96
7	Yield	4.38	5.88	5.21

The level of adoption of seed rate ranges between 0.77 to 0.93, majority of the farmers followed recommended sowing time. Application of N ranges between 0.80 to 0.99, application of P between 0.41 to 0.72, plant protection 0.38 to 0.75 and time of harvesting 0.91 to 0.96 and yield between 4.38 q/hect to 5.88 q/hect. The yield received by cultivators are poor than the recommended yields. The yield harvested by selected farmers are about 60 percent of the recommended yield.

The composite Index of adoption

The composite index of adoption of recommended technologies in udid are worked out and presented in following tables.

Table 3: Eigen value and proportion of selected technologies in udid production

	Seed rate	Time of sowing	N	P	Harvesting
Eigen value	2.891	1.3192	0.649	0.212	0.007
Proportion	0.546	0.281	0.130	0.042	0.001
Cumulative	0.564	0.826	0.956	0.999	1.000

Table 4: Distribution of selected cultivators in udid production

Sr. No.	Level of adoption		
	Low	Medium	High
1	0.3339	0.6072	0.8832
2	0.3593	0.6095	0.9123
3	0.4201	0.6109	0.9929
4	0.4249	0.6196	0.9548
5	0.4329	0.6198	0.9618
6	0.4556	0.6299	
7	0.4571	0.6342	
8	0.4583	0.6489	
9	0.4657	0.6788	
10	0.4687	0.6793	
11	0.4742	0.6813	
12	0.4883	0.7111	
13	0.5134	0.7248	
14	0.5226	0.7516	
15	0.5441	0.7712	
16	0.5492	0.7924	
17	0.5459	0.7958	
18	0.5534		
19	0.5673		
20	0.5885		
21	0.5897		
22	0.5912		
23	0.5931		
24	0.5982		

The total 46 cultivators are classified in low medium and high adopters according to their level of adoption.

Contribution of technologies in yield gap

The contribution of each technology in yield gap in udid production are presented in table.

Table 5: Contribution of technologies in udid production

Sr. No.	Technology	Udid	
		Coefficient	Contribution
1	Seed rate	0.9332**	21.98
2	Time of sowing	0.5212**	14.04
5	N	1.018**	
6	P	1.41**	33.54
7	K	-	
8	Plant Protection	0.5211	1.39
9	Harvesting	1.031**	18.79
10	Yield	5.16	4.84

* Significant at 5% level of significance, ** Significant at 1% level of significance

In udid production. Seed rate, time of sowing, N, P and Harvesting time are the major contributors of yield gap to the extent of 4.58 q/ha.

CONCLUSIONS

1. Seed rate, time of sowing application of N, P, Plant protection and appropriate harvesting time are the technologies adopted by udid cultivation.
2. The distribution of udid cultivators indicated that out of 46 udid cultivators 24 in low, 17 in medium and 5 in high adopters.
3. Seed rate, time of sowing, applicable of N, P and harvesting time are the important technologies in udid production.

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