



## Research Article

# STUDIES ON MULTIPLE/RELAY CROPPING INDEX UNDER NEWLY DEVELOPED CROPPING SYSTEMS AND ITS EFFECT ON INCOME OF FARMERS

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**Abstract:** The field study was carried out during two consecutive years of 2013-2014 and 2014-2015 at pilot area of Kannauj, Farrukhabad, Unnao, Hardoi and Mainpuri, C.S. Azad University of Agriculture and Technology, Kanpur, under NABARD and RKVY Projects in 25 villages, where maize and potato are cultivating by farmers as a major enterprises. The cultivars, Azad Uttam and short duration hybrid maize, Kufri Bahar, Kufri Pukharaj, Kufri Pushker, Kufri Ashok, Kufri Anand, Kufri Satlaj, Kufri Jawahar, Kufri Jyoti, Kufri Gulal of potato and ICGV 93468 (Avtar) and Dh 86 of summer groundnut and Sonalika of coriander for green leaves were planted in selected area of 25 villages. The average productivity of maize recorded 30.05 q/ha. The average yield of potato tubers, grown after maize was noted 355.00 q/ha. The summer groundnut yielded by 30.10 q/ha. The coriander grown during mid rainy season between maize and potato crops yielded green leaves by 52.50 q/ha. The highest net return was found Rs. 512875.00 /ha under maize-coriander leaves-potato-summer groundnut. Maize-potato-summer groundnut gave net return Rs. 224480.00/ha. The lowest net return was computed Rs. 121490.00/ha in maize-potato cropping system. The net income of farmers increased 1.80 and 4.22 fold due to maize-potato-summer groundnut and maize-coriander leaves-potato-summer groundnut cropping system, respectively, as compared to maize-potato. Similarly, multiple/relay cropping index increased to the extent of 2.80 and 3.00 by growing of maize-potato-summer groundnut and maize-coriander for green leaves-potato-summer groundnut, respectively, over maize-potato / conventional system (1.80).

**Keywords:** Coriander, Fold, Index

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## Introduction

It is well known fact that the adequate supply of fertilizers, assured irrigation and technical knowhow are essential for increasing the multiple/relay cropping index. For increasing this index, two system i.e., multiple cropping and relay cropping becomes essential. The index of multiple and relay cropping was 1.5 before the introduction of summer groundnut in Agra, Aligarh, Kanpur and Lucknow. But its possibility of this index was observed more than 3. The farmers of aforementioned regions are very analytical and they compute overall net income in term of cropping system rather than the more enterprise. The short duration variety of maize with low production capacity is scarified with a view to plant early potato to catch early market and fetch better price with double crop of potato. Thus, in multiple/relay cropping, maize has important place and it grown about 362461 ha area in above regions. Similarly, for high multiple/relay cropping index potato is also one of the most important crops because of the fact that it is short duration crop with very wide regional and seasonal adaptability. In most of the potato growing areas, cultivation of two crop of potato in succession is possible on the same piece of land. It is, therefore, remunerative and highly adaptable crop under multiple cropping in the above regions due to sufficient facility of irrigation, fertilizer and soil type. So far, groundnut is an important Kharif season oil seed crop of Uttar Pradesh. Its area, production and productivity declined after 1980s and still continue. A strong need was felt to develop a suitable technology for groundnut cultivation under moisture and thermal condition to revive groundnut production and utilize the vacant field of potato for increasing multiple/relay cropping index. Among the varieties, Dh 86 and ICGV 93468 (Avtar) were found most suitable for summer season. The varieties fitted in increasing the income of farmers and multiple/relay cropping index in the maize - potato growing tract.

Recently coriander cultivation for green leaves production during mid rainy season between maize and potato was also found more suitable for increasing farmers income and enhancing multiple/relay cropping index. Therefore, increasing the income of farmers two fold or more than two fold and enhancing multiple/relay cropping index is the subject matter of this manuscript.

## Materials and methods

The study was undertaken during two consecutive years of 2013-2014 and 2014-2015 at selected area of Kannauj, Farrukhabad, Unnao, Hardoi and Mainpuri, C.S. Azad University of Agriculture and Technology, Kanpur, under NABARD and RKVY Schemes on 500 ha area of 25 villages, where maize and potato are cultivating by farm families as major enterprises. The soil of pilot area was sandy loam, having pH 8.0, organic carbon 0.26, total nitrogen 0.02%, available phosphorus 8.8 kg/ha and available potash 277 kg/ha, therefore, the results of composite sample of soil indicated poor fertility status. The pH was determined by Electrometric glass electrode method, while organic carbon was determined by Colorimetric method [1,2]. Total nitrogen was analyzed by Kjeldahl's method as discussed by [3]. The available phosphorus and potassium were determined by Olsen's method and Flame photometric method [9], respectively. Three cropping system i.e., maize-potato (conventional system) maize-potato-summer groundnut and maize - coriander for green leaves-potato-summer ground nut were tested. Maize cultivars Azad Uttam and early maturing hybrid were planted in the end of June and harvested in first fortnight of October in two years of experimentation. Potato tubers of selected cultivars, given in abstract were seeded during first fortnight of November and harvested after complete maturity in both years of experimentation.

Table-1 Statement showing the yield of enterprises, income increased and multiple/relay cropping index (Pooled data of two years)

SN	Cropping system	Average yield (q/ha)				Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	Increased net income in fold	Multiple/ relay cropping index
		Maize	Potato	Coriander	Summer groundnut					
1	Maize-potato (conventional system)	30.05	355	-	-	110290	231780	121490	-	1.8
2	Maize-potato-summer groundnut	30.05	355	-	30.1	172860	397340	224480	1.8	2.8
3	Maize-coriander leaves-potato-summer groundnut	30.05	355	52.5	30.1	203665	716540	512875	4.22	3

The mid season of coriander cv. Sonalika was risen after harvesting of maize between 10-15 August and harvested between 15-30 October during both experimental seasons. The cvs. Dh 86 and ICGV 93468 (Avtar) was sown first fortnight of March and harvested after 85-90 days in first fortnight of June in both seasons of experiment. The recommended agronomical practices were followed in experimental crops during both the years. The irrigations were given to the crops as and when required. The experiment was conducted on farmers' fields. The yield data and area covered by experimental crops under sequential cropping were collected and average was made.

### Results and Discussion

The pooled data of two years are given in [Table-1] and discussed here under appropriate heads.

### Productivity of enterprises

The average productivity of maize, cvs. Azad Uttam and short duration hybrid recorded 30.05 q/ha. The different varieties of potato grown after maize gave average yield of tubers as 355.00 q/ha. The summer groundnut rose under maize-potato-summer groundnut and maize-coriander for green leaves-potato-summer groundnut cropping systems gave average yield of 30.10 q/ha. The coriander rose between the maize and potato crops yielded green leaves by 52.50 q/ha. The better average yields of different crops under different cropping system were due to follow of suitable agronomic practices, as suggested [4-8].

### Economic study

The data recorded under economic study have been presented in [Table-1]. The highest cost of cultivation under treatment of maize-coriander for green leaves-potato-summer groundnut was computed Rs. 203665/ha. The cost of cultivation was computed Rs. 172860 /ha and Rs. 110290/ha under maize-potato-summer groundnut and maize-potato, respectively. The increase and decrease cost of cultivation were depend on the numbers of crops in cropping systems. The higher gross return of Rs. 716540/ha, net return of Rs. 512875/ha and farmers net income increase of 4.22 fold were found with harvesting of maize-coriander for green leaves-potato-summer groundnut cropping system. Maize-potato-summer groundnut displayed gross return of Rs. 397340/ha, net return of R. 224480/ha and net income increase of 1.80 fold. The lowest gross return of Rs. 231780/ha and net return of Rs. 121490/ha were found under maize –potato. The number of crops of cropping system, supported to the increase and decrease of net income and net income in fold.

### Multiple / relay cropping index

Perusal of data make it clear that prior to introduction and inclusion of summer groundnut and coriander for leaves in cropping systems, the multiple/relay cropping index was 1.80 but after inclusion groundnut, it was enhanced to the extent of 2.80. Similarly, inclusion of coriander for leaves in the rotation of maize-coriander for green leaf-potato-summer groundnut, it was pushed up to the extent of 3.00.

### Conclusion

The maize-potato-summer groundnut and maize-coriander for green leaves-potato-summer groundnut cropping systems increased the net income of farm families by 1.80 and 4.22 fold, respectively. The multiple/relay cropping index enhanced from 1.80 to 2.80 due to maize-potato summer groundnut and 1.80 to 3.00 due to maize-coriander for green leaves-potato-summer groundnut.

**Application of research:** Therefore, farm house hold of potato growing tract may be advocated for adoption of maize-potato-summer groundnut and maize-

coriander for green leaves-potato-summer groundnut cropping systems for harvesting the fruits of generated technology.

### Research Category: Cropping systems

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**Study area / Sample Collection:** Uttar Pradesh, India

**Cultivar / Variety / Breed name:** Maize, Potato, Groundnut, Coriander

**Conflict of Interest:** None declared

**Ethical approval:** This article does not contain any studies with human participants or animals performed by any of the authors.  
Ethical Committee Approval Number: Nil

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