Influence of Farming Methods on Value Chain of Agriculture : An Empirical Study for Uttar Pradesh

** Ajai Prakash*
*** Ankit Srivastava*

Abstract

The current research has been conducted on the state of agriculture in Uttar Pradesh. The research endeavoured to find out the impact of traditional and modern farming methods on value creation in agriculture in the state of Uttar Pradesh. Uttar Pradesh is primarily an agrarian economy. It has emerged from the study that agriculture is influenced by both modern and traditional farming. The results indicated that a number of farmers follow a blend of traditional and modern methods of farming. It was also observed that the farm linkages to other agriculture supporting activities were broken. Hence, the economies of scale and scope could not be reaped in the state of Uttar Pradesh. Probably, a high production of agricultural products is the outcome of the vast expanse of land under cultivation. An exploratory study was conducted in order to understand the above piece of research. Descriptive statistics showed how agricultural trends have been outlined. With the help of the Kruskal-Wallis test (non-parametric alternative of one way ANOVA) and Man-Whitney test, it was found that there are significant differences among various farming methods in the value addition process.

Keywords : **agrarian, agriculture, agricultural economics, farming, agricultural value chain**

JEL Classification : Q000, Q1, Q190

Paper Submission Date : February 20 , 2016 ; Paper sent back for Revision : May 27, 2016 ; Paper Acceptance Date : September 5, 2016

Agriculture is a prominent segment of the Indian economy as it accounts for approximately 11.6% (2012-13) of GDP and approximately 12% of total exports (Department of Agriculture and Cooperation Ministry of Agriculture, Government of India, 2013). Despite a gradual decline of agriculture's share in GDP, it is still a major economic sector that employs approximately 53% (Planning Commission, Government of India, 2014) of the country's population and definitely plays an important role in the overall socioeconomic development of the country. It is important to recognize that agriculture strongly supports Indian families through supply of agri produce directly to them. Agriculture in India significantly depends on monsoons but the methods of farming have an important role in enhancing value in agricultural produce. This paper is an attempt to understand how Indian Agriculture is influenced by choosing between traditional and organic methods or modern scientific methods of farming in Uttar Pradesh. The essence of the study lies in identifying how various methods of farming influence the value chain of agriculture in India. The study had been conducted in the state of Uttar Pradesh.

Indian Agriculture

Cropping system in India was developed through Vedic times, and the pre-Christian era in the west adopted

* *Assistant Professor,* Department of Business Administration, University of Lucknow, Lucknow - 226007, Uttar Pradesh.
** *Senior Research Fellow,* Department of Business Administration, University of Lucknow, Lucknow - 226007, Uttar Pradesh. E-mail : srivastava.ankit09@gmail.com

principles of matching climate, crops, and seasons. This enabled the prolongation of the growing period, and this could be considered the beginning of methodical development of cropping systems. In previous times natural processes like crop residues were more in practice and were incorporated in order to enhance the productivity of soil as it provides organic matter to enhance the biological activity of soil. Intensification of agriculture moved away from these systems due to the development of species and varieties with high harvest indices. Historically, agricultural growth and increases in agricultural productivity have been a prerequisite for sustained economic growth and development (Kumar & Shivay, 2008). Even though the share of agriculture in GDP has fallen in recent years, it is still an important part of majority of developing economies and also an important source of economic development of society.

Agriculture Policies in India

According to Bhardwaj (1974), it is difficult to identify the production methods or production conditions of Indian agriculture as the objectives of farming are not same for each producer, supposedly some are profit oriented and some are not. Since the very first five year plan several packages of technology, services and public policies have been introduced for betterment of the agricultural sector. Consequently, India has changed its image from a poor one to a strong one and currently holds the first or second position in terms of production of several major crops and other agricultural produces. India occupies the first position in milk production globally and has been able to build substantial buffer stocks of food grains. The per capita food grain accessibility has also improved by one and half times. Agriculture also provides for a number of agro-based industries and agro-services. It is better not to consider agriculture as agriculture alone but as a holistic value chain, which includes farming, wholesaling, warehousing (including logistics), giving out, and retailing.

Agricultural Value Chain

Miller and da Silva (2007) define value chain as the set of players (private, public, and service providers) and the series of value-adding actions involved in carrying an end product from production to the final consumer. In reference to agriculture, the whole process can be thought of as a 'farm to fork' set of processes and flows. Traditional agricultural value chains are generally governed through spot market transactions involving a large number of small retailers and producers. Modern value chains are characterized by vertical coordination, consolidation of the supply base, agro-industrial processing and use of standards throughout the chain. More precisely the term 'value chain' has been defined by Hobbs, Cooney, and Fulton (2000) as a vertical coalition or strategic network between a number of independent business organizations within a supply chain.

Methods of Farming

The following section discusses the various methods of farming adopted by farmers. Three broad heads have been considered for the study. These are traditional, organic, and modern farming methods. For our study we have taken traditional and organic farming as one set and modern methods as the other.

(1) Traditional and Organic Farming : Traditional farming (Festivalalimenterre, 2013) is the method of farming developed through ages mostly with interaction of social and environmental systems. This method involves intensive use of local knowledge and natural resources supporting biological diversity by means of alternating practices that include various farming methods and crop rotation. These methods of farming are focused on maintaining soil fertility, prevention of loss of topsoil, hold water in soil, and in producing stable harvests. Among

all the farming methods this method aims at retaining a high degree of biodiversity.

Organic farming techniques include crop rotation, compost, green manure and biological pest control. Organic farming uses natural fertilizers and pest control techniques and excludes the use of chemical or hazardous forms of fertilizers and pesticides. According to the International Federation of Organic Agriculture Movements (IFOAM Organics International), Organic farming not only maintains the health of soils and ecosystem but it is concerned with the well being of people also. Organic farming is dependent upon ecological processes, biodiversity and cycles acclimatized to local environment. It also avoids the use of inputs that may affect adversely (harmful or negative). It combines tradition, innovation, and science to keep the interests of shared environment and encourages a fair relationship and a good quality of life for all stakeholders.

Badgley et al. (2007) defines organic farming as farming practices that are agro ecological, sustainable, or ecological; utilize natural (non-synthetic) nutrient-cycling processes; exclude or rarely use synthetic pesticides; and sustain or regenerate soil quality. These practices may include cover crops, manures, compost, crop rotation intercropping and biological pest control.

(2) Modern Methods of Farming : The term "modern agriculture" is akin to commitment for innovation, stewardship and meeting the global food challenge all at once. There is nothing conventional about that (Crop Life America, n.d.). Agricultural methods are the blend of optimum human efforts and innovative science to create a balance of farm inputs that optimize farm outputs and at the same time try to reduce the latent effects on the environment. The modern methods of farming include tools like conversation tillage, integrated pest management and crop rotation that are concerned with sustainability and better crop yields. In the system of modern agriculture farmers believe they have a much more central role and are eager to apply technology and information to control most components of the system, a very different view from that of traditional farmers (Giovannucci, 2007). In traditional arrangements, modern agriculture tends to see its success as dependent on linkages - access to resources, technology, management, investment, markets, and supportive government policies.

Modern farming emphasizes on large scale monoculture forms of cultivation involving a single crop that caused a damaging relationship between ecology and farming activities. This relation can be said to be a highly vulnerable expansion of the agro-ecosystem.

(3) Uttar Pradesh - A Highlight : Uttar Pradesh is the fourth largest state by land area in India and the most populous state with almost 200 million people. The larger Gangetic plain is in north that includes the Ganges-Yamuna Doab, the Ghaghra plain and the Terai. Uttar Pradesh has a humid subtropical climate and experiences four seasons. These highly fertile conditions of Uttar Pradesh make agriculture a very important portion in the economy of Uttar Pradesh. More specifically the Ganga-Yamuna plains not only provide food to the people but raw materials also to many farm-based industries.

During the year 2010-11, Uttar Pradesh produced an all time high 47.55 metric tonnes of food grains, which was an increase of almost 10% from last year. This state contributed 20% of the country's total food grain production in year 2010-11. It produced 13% of the country's overall rice, 35% of wheat, 13% of pulses and 8% of coarse cereals yield in the country in the year 2010-11. The statistics show that production percentages have risen in the past few years (Mukherjee, 2011).

Objectives of the Study

The objectives of the study are:

(1) To describe the current status of farmers in the state of Uttar Pradesh (U.P.).

(2) To understand the influence of farming methods in enhancing the value of agricultural value chain.

Research Methodology

The research was exploratory in nature. The research was designed to describe the basic structure of farming in the state of Uttar Pradesh and the impact of farming methods adopted by them on the value chain of agriculture. For the purpose of data collection the universe i.e. Uttar Pradesh state was divided in eastern, central, and western regions. The time period of the study was from February 2014 to December 2014, that is, data for the study was collected between these months. A stratified random sampling was applied for the purpose of collecting data. 30 districts (10 districts from each region) out of a total of 70 districts of the state were selected from an alphabetical list. The respondents chosen were farmers. These respondents were administered questionnaires at the 'Galla Mandis' (agrimarket farmyards) of the districts. 20 random farmers were contacted at this point. A total of 600 questionnaires were filled by 20 farmers from 30 districts each. Only 432 questionnaires out of the 600 questionnaires were valid and considered for analysis. SPSS software had been used for data analysis.

↳ **Hypotheses :** The following hypotheses were considered for analysis:

↳ **$H0_1$:** There is no significant difference in the value addition generated by modern scientific methods and traditional & organic methods of farming in case of food grains and cash crops.

↳ **$H0_2$:** There is no significant difference in the value addition generated by modern scientific methods and a combination of modern scientific methods and traditional & organic methods of farming in case of food grains and cash crops.

↳ **$H0_3$:** There is no significant difference between the value addition process between traditional & organic methods and a combination of modern scientific methods and traditional & organic methods of farming.

Analysis and Interpretation

(1) Cross-Tabulation Analysis : Cross tabulation analysis was conducted to analyze the current state of farmers and allied activities. The cross tab analysis (Table 1) between methods of farming and size of farms shows that the majority of farmers are using a combination of modern scientific methods and traditional & organic farming methods. It is also clear that most of the farmers who use such combination have farm size of 12 bighas and above. This piece of analysis was conducted to understand whether farmers make use of various agriculture advancements.

From the analysis shown in Table 2, between farming methods and owning/using agricultural equipments we

Table 1. Method for Increasing Value Addition in Agriculture * Size of Farm (Bighas)

		Q9- Size of Farm (Bighas)				Total
		0-4	5-8	9-12	Above 12	
Q2- Which according to you	Modern Scientific Methods	0	9	27	33	69
is the most viable method for	Traditional & Organic Farming	6	12	12	24	54
increasing value addition in	A combination of both A & B	33	90	66	102	**291**
agriculture?	Agricultural Diversification	3	6	3	6	18
Total		42	117	108	**165**	**432**

Table 2. Method for Increasing Value Addition in Agriculture * Agricultural Equipments

		Q14- Agricultural Equipments				Total
		No	Crop Harvester	Tubewell	Threasher	
Q2- Which according to you is the most viable method for increasing value addition in agriculture ?	Modern Scientific Methods	60	0	6	3	**69**
	Traditional & Organic Farming	54	0	0	0	**54**
	A combination of both A & B	273	15	3	0	**291**
	Agricultural Diversification	15	0	0	3	**18**
Total		**402**	**15**	**9**	**6**	**432**

Table 3. Most Viable Method for Increasing Value Addition in Agriculture * Activities Along with Agriculture

		Q15- Undertake activities along with Agri.							Total
		No	Dairy Farming	Milkman	Poultry farming	Fish farming	Bee-Keeping	Goat	
Q2- Which according to you is the most viable method for increasing value addition in agriculture?	Modern Scientific Methods	54	15	0	0	0	0	0	69
	Traditional & Organic Farming	48	0	3	0	0	0	3	54
	A combination of both A & B	276	6	3	3	3	0	0	291
	Agricultural Diversification	9	6	0	0	0	3	0	18
Total		387	27	6	3	3	3	3	432

can derive that approximately 93% (402 out of 432) farmers do not use or own any kind of agricultural equipment e.g. oil extraction plant, crop harvester, thresher etc.

Another analysis to understand the current level of farming was conducted to determine whether farmers undertake additional activities other than growing of crops as part of agriculture activities. Table 3 clearly indicates that almost 90% of the farmers do not carry any other agricultural activity along with farming e.g. dairy, poultry, fisheries, bee-keeping or goat keeping. This clearly represents the lack of sustainability and makes farmers dependent only on unnatural resources as all such activities can be seen as a chain of interdependent activities all along.

(2) Hypotheses Testing : In order to test the significant differences between the group means, first the normality

Table 4. Tests of Normality

Q2- Which according to you is the most viable method for increasing value addition in agriculture?		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
Q1a- Food grains	Modern Scientific Methods	.351	69	**.000**	.636	69	**.000**
	Traditional & Organic Farming	.368	54	**.000**	.632	54	**.000**
	A combination of both A & B	.444	291	**.000**	.610	291	**.000**
	Agricultural Diversification	.334	18	**.000**	.642	18	**.000**
Q1b- Cash Crops	Modern Scientific Methods	.404	69	**.000**	.679	69	**.000**
	Traditional & Organic Farming	.444	54	**.000**	.458	54	**.000**
	A combination of both A & B	.443	291	**.000**	.579	291	**.000**
	Agricultural Diversification	.260	18	**.002**	.807	18	**.002**

a. Lilliefors Significance Correction

was checked. Normality is tested with the help of Kolmogorov-Smirnov test. The result shows in Table 4 that the data is not normally distributed. Homogeneity of variances was checked with Levene statistic and the result in Table 5 shows negative sign for the homogeneity which strongly discourages the use of parametric test. As the test shows that data is not normally distributed (Table 4), the analysis is done with the help of Kruskal Wallis H Test (One way ANOVA on Ranks) that is a non-parametric alternative of one way ANOVA.

A Kruskal Wallis H test shows that there is a statistically significant difference in the means of different farming methods with $p < 0.05$ (Table 7) in case of both food grains and cash crops. The mean ranks of different groups of farming methods are shown in Table 6. These values show the presence of *significant differences* in the means of groups, but to identify the desired groups with significant differences we then applied Man-Whitney test for separate combinations of sample groups.

↳ **$H0_1$:** There is no significant difference in the value addition through modern scientific methods and traditional & organic methods of farming in case of food grains and cash crops.

In order to study the significance of the above hypothesis a comparison of modern scientific methods usage

Table 5. Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Q1a- Food grains	10.005	3	428	.000
Q1b- Cash Crops	12.589	3	428	.000

Table 6. Kruskal Wallis Test

Ranks			
	Q2- Which according to you is the most viable method for increasing value addition in agriculture ?	*N*	Mean Rank
Q1a- Food grains	A-Modern Scientific Methods	69	253.87
	B-Traditional & Organic Farming	54	246.67
	C-A combination of both A & B	291	199.44
	D-Agricultural Diversification	18	258.50
	Total	432	
Q1b- Cash Crops	A-Modern Scientific Methods	69	261.11
	B-Traditional & Organic Farming	54	219.33
	C-A combination of both A & B	291	203.26
	D-Agricultural Diversification	18	251.00
	Total	432	

Table 7. Test Statistics[a,b]

	Q1a- Food grains	Q1b- Cash Crops
Chi-Square	25.311	26.880
Df	3	3
Asymp. Sig.	.000	.000

a. Kruskal Wallis Test

b. Grouping Variable: Q2- Which according to you is the most viable method for increasing value addition in agriculture?

Table 8. Ranks

	Q2- Which according to you is the most viable method for increasing value addition in agriculture?	*N*	Mean Rank	Sum of Ranks
Q1a- Food grains	Modern Scientific Methods	69	62.91	4341.00
	Traditional & Organic Farming	54	60.83	3285.00
	Total	123		
Q1b- Cash Crops	Modern Scientific Methods	69	67.54	4660.50
	Traditional & Organic Farming	54	54.92	2965.50
	Total	123		

Table 9. Test Statistics[a]

	Q1a- Food grains	Q1b- Cash Crops
Mann-Whitney U	1800.000	1480.500
Wilcoxon W	3285.000	2965.500
Z	-.372	-2.705
Asymp. Sig. (2-tailed)	.710	.007

a. Grouping Variable: Q2- Which according to you is the most viable method for increasing value addition in agriculture?

and traditional & organic methods on food grains and cash crops respectively was done. The mean ranks of above two groups show that modern scientific methods have higher mean ranks (higher value addition) over traditional & organic farming methods in case of both food grains and cash crops (Table 8). On the basis of results obtained in Table 9, the null hypothesis $H0_1$ is accepted in case of food grains as the sig. value for these two groups is ">0.05", that is, 0.710 (for food grains) and the null hypothesis $H0_1$ is rejected in case of cash crops as the sig. value for these two groups is "<0.05" (in case of cash crops).

↳ **$H0_2$:** There is no significant difference in the value addition generated through modern scientific methods and a combination of (A) modern scientific methods and (B) traditional & organic methods of farming in case of food grains and cash crops.

In order to study the significance of the above hypothesis a comparison of modern scientific methods usage and a combination of modern scientific methods and traditional & organic methods on food grains and cash crops respectively was performed. Man-Whitney Test was used for the same.

The mean ranks of above two groups show that modern scientific methods have higher mean ranks over a combination of both A & B, in case of both food grains and cash crops (Table 10). On the basis of result obtained

Table 10. Ranks

	Q2- Which according to you is the most viable method for increasing value addition in agriculture?	*N*	Mean Rank	Sum of Ranks
Q1a- Food grains	Modern Scientific Methods	69	217.15	14983.50
	A combination of both A & B	291	171.81	49996.50
	Total	360		
Q1b- Cash Crops	Modern Scientific Methods	69	219.37	15136.50
	A combination of both A & B	291	171.28	49843.50
	Total	360		

Table 11. Test Statistics[a]

	Q1a- Food grains	Q1b- Cash Crops
Mann-Whitney U	7510.500	7357.500
Wilcoxon W	49996.500	49843.500
Z	-4.086	-4.873
Asymp. Sig. (2-tailed)	.000	.000

a. Grouping Variable: Q2- Which according to you is the most viable method for increasing value addition in agriculture?

Table 12. Ranks

	Q2- Which according to you is the most viable method for increasing value addition in agriculture ?	*N*	Mean Rank	Sum of Ranks
Q1a- Food grains	Traditional & Organic Farming	54	204.83	11061.00
	A combination of both A & B	291	167.09	48624.00
	Total	345		
Q1b- Cash Crops	Traditional & Organic Farming	54	184.33	9954.00
	A combination of both A & B	291	170.90	49731.00
	Total	345		

Table 13. Test Statistics[a]

	Q1a- Food grains	Q1b- Cash Crops
Mann-Whitney U	6138.000	7245.000
Wilcoxon W	48624.000	49731.000
Z	-3.249	-1.380
Asymp. Sig. (2-tailed)	.001	.168

a. Grouping Variable: Q2- Which according to you is the most viable method for increasing value addition in agriculture?

(Table 11), the null hypothesis $H0_2$ is rejected and alternate hypothesis is accepted as the sig. value for these two groups is "< 0.05" for both food grains and cash crops.

↳ **$H0_3$:** There is no significant difference between the value addition process between traditional & organic methods and a combination of (A) modern scientific methods and (B) traditional & organic methods of farming.

In order to study the significance of the above hypothesis a comparison of traditional & organic methods and a combination of modern scientific methods and traditional & organic methods on food grains and cash crops respectively was performed. The mean ranks of above two groups show that traditional & organic methods have higher mean ranks over a combination of both A & B, in case of both food grains and cash crops (Table 12). On the basis of result obtained in Table 13, the null hypothesis $H0_3$ is *rejected* in case of food grains as the *p* value for these two groups is "<0.05" i.e. 0.01 and the null hypothesis $H0_3$ is *accepted* in case of cash crops as the *p* is > 0.05 i.e. 0.168.

The above analysis of differences in means of groups show that there is significant difference between the value addition process between modern scientific methods and a combination of modern scientific methods and traditional and organic methods of farming. This means the use of traditional & organic methods with a blend of modern scientific methods can add more value to agriculture as compared to the use of only modern scientific methods.

Research Findings and Policy Implications

The findings show that in some ways the combination of modern scientific methods and traditional and organic methods of farming generates more value to the agricultural value chain. Therefore, farmers who pursue any of the given kind of farming methods are suggested to use a combination of both the farming methods to increase the value throughout their agricultural activities.

Connor (2008) studied and found that only organic farming would not be able to feed the whole world. De Ponti, Rijk, and Van Ittersum (2012) compared yield data of organic and conventional agriculture and found that organic yields of individual crops are on average 80% of conventional yields. Ponisio et al. (2015) suggested that adopting diversification practices in agriculture may help reduce yield gap between organic and conventional farming. Seufert, Ramankutty, and Foley (2012) also reached to conclusion that organic yields are typically lower than conventional yields.

In the light of above findings and our findings, policy implications are as follows:

(i) Policy Implication 1: Farmers are suggested to use a blend of traditional & organic farming methods and modern scientific methods for adding more value to their agricultural activities.

(ii) Policy Implication 2: As the majority of farmers are not owning or using any agricultural equipment, it can reduce the total value generated as manual processes take more time than machineries. It is therefore suggested to employ optimum level of man and machine combination.

(iii) Policy Implication 3 : The farmers are suggested to carry other activities along with agriculture such as dairy, fisheries, poultry etc. as these activities can provide natural resources. The requirement of fertilizers can be fulfilled by manure/dung, cattle can be used for ploughing and some carriage etc.

Limitations of the Study and Scope for Further Research

The present study was conducted in only 30 districts of Uttar Pradesh state. In this research the farmers were contacted at district galla mandis, which could have left behind the marginal and landless farmers upto some extent. The study could be done in other states as well, with agriculture as their major economic activity. Contacting the farmers at their farms instead of at galla mandis could help to get responses from marginal and landless farmers which could lead to enhanced understanding of the issue.

References

Badgley, C., Moghtader, J., Quintero, E., Zakem, E., Chappell, M.J., Avilés-Vázquez, K., Samulon, A., & Perfecto, I. (2007). Organic agriculture and the global food supply. *Renewable Agriculture and Food Systems, 22*, 86-108. doi:10.1017/S1742170507001640.

Bhardwaj, K. (1974). *Production conditions in Indian agriculture: A study based on farm management survey* (Occasional Paper 33). Cambridge : Department of Applied Economics, Cambridge University Press.

Connor, D. J. (2008). Organic agriculture cannot feed the world. *Field Crops Research, 106* (2), 187-190. DOI: 10.1016/j.fcr.2007.11.010

Crop Life America. (n.d.). *Modern agriculture.* Retrieved from http://www.croplifeamerica.org/crop-protection/modern-agriculture

Damiani, O. (2003). *The adoption of organic agriculture among small farmers in Latin America and the Caribbean: Thematic evaluation*. Rome: IFAD.

De Ponti, T., Rijk, B., & Van Ittersum, M. K. (2012). The crop yield gap between organic and conventional agriculture. *Agricultural Systems, 108,* 1-9. doi: http://dx.doi.org/10.1016/j.agsy.2011.12.004

Department of Agriculture and Cooperation Ministry of Agriculture, Government of India (2013). *The pocket book on agricultural statistics.* New Delhi : Department of Agriculture.

Festivalalimenterre (2013). Documentary film festival: The world on a plate. Retrieved from http://2013.festivalalimenterre.cz/en/vice-k-tematu/tradicni-a-udrzitelne-praktiky-v-zemedelstvi/

Field, A. (2009). *Discovering statistics using SPSS (and sex and drugs and rock 'n 'roll)*. Thousand Oaks : Sage Publication.

Giovannucci, D. (2007). *Organic Farming as a tool for productivity and poverty reduction in Asia.* Prepared for the International Fund for Agricultural Development /NACF Conference Seoul. Retrieved from http://www.dgiovannucci.net/docs/giovannucci_organic_farming_as_tool_for_productivity_and_poverty_reduction-nacfseoul%20.pdf

Hobbs, J.E., Cooney, A., & Fulton, M. (2000). *Value chains in the agri-food sector.* Saskatoon, Canada : Department of Agricultural Economics, University of Saskatchewan.

IFOAM Organics International. (n.d.). *Organic basics.* Retrieved from https://www.ifoam.bio/en/our-library/organic-basics

Kumar, D., & Shivay, Y. S. (2008). *Modern concepts of agriculture*. Retrieved from https://www.researchgate.net/profile/Yashbir_Shivay2/publication/237569012_Integrated_Crop_Management/links/004635281b6c92bf6e000000.pdf on 31-08-2016

Miller, C., & da Silva, C. (2007). Value chain financing in agriculture. *Enterprise Development and Microfinance, 18* (2-3), 95-108.

Mukherjee, S. (2011, July 5). UP ranked among the best states in grain production. *Business Standard.* Retrieved from http://www.business-standard.com/article/economy-policy/up-ranked-among-the-best-states-in-grain-production-111070500059_1.html

Planning Commission, Government of India (2014). *NSSO Data Source, Table from Employment across various sectors, NSSO 66th Nationwide Survey*, p. 116.

Ponisio, L. C., M'Gonigle, L. K., Mace, K. C., Palomino, J., de Valpine, P., & Kremen, C. (2015). Diversification practices reduce organic to conventional yield gap. *Proceedings of the Royal Society B, 282*(1799). DOI: 10.1098/rspb.2014.1396

Seufert, V., Ramankutty, N., & Foley, J.A. (2012). Comparing the yields of organic and conventional agriculture. *Nature, No. 485*, 229 - 232. doi:10.1038/nature11069