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Organic versus GMO farming: Contamination, what contamination?

> "… the late November/early December 2010 airborne incursion of GM canola swathes into Eagle Rest (described by the Marshes in their pleadings and submissions in tendentious fashion as a 'contamination')" Justice Kenneth Martin (2014, p.15).

A landmark case against the planting of GMO crops in Australia has delivered a big win for GMO farmers and produced no protection for organic farmers. The case pitted farmer against farmer. An organic farmer, Steve Walsh, initiated the legal action against his GMO growing neighbour, Michael Baxter in the Supreme Court of Western Australia (Martin, 2014).

The Marsh and Baxter farms (477 hectares and 900 ha. respectively) are adjacent to each other and located in Kojonup, 260 km south east of the capital city of Perth in the wheat belt of Western Australia (WA) - and coincidentally nearby Broomhill was one of the earliest sites in the development of the organic movement in Australia (from 1930) (Paull, 2013a). Just before Baxter's first crop of Monsanto's genetically modified (GM) Roundup Ready (RR) canola (a variety of rape) was harvested, the standing crop was sprayed with herbicide (glyphosate), and rather than being direct harvested, the crop was swathed, i.e. the stalks were mown off at their base, dropped *in situ* and windrowed, and left in the field (exposed to the elements) for collection in two or three weeks. GMO swathes, seeds and plant material were subsequently found dispersed over much of Marsh's farm. As a consequence 70% of Marsh's farm lost its organic certification (from 29 December 2010 until it was restored in October 2013) (Martin, 2014).

Marsh sued Baxter for economic loss (agreed between the parties as $85,000), on the basis of common law negligence or private nuisance, and sought a permanent injunction, initially to stop Baxter in future planting GM canola in paddocks adjacent to Marsh's organic fields and finally lessened to stopping Baxter harvesting GM canola by swathing in adjacent paddocks. The case ran over three weeks, and was then dismissed in its entirety; so no nuisance, no negligence, no injunction, and no damages (Martin, 2014).

The cornerstone of the case was that Marsh's organic farm had been "contaminated" with GMO plant material. There was no dispute that GM canola plant material was blown onto 70% of Marsh's farm, no dispute that it came from Baxter's farm, and not even any dispute that Baxter's chosen harvesting method of swathing created the precondition for the wind to blow the GMO material into Marsh's farm. But the case foundered on the characterisation of the "incursion" as "contamination" which characterisation was never accepted by the Judge who commented, early in his 150 page judgement: "the late November/early December 2010 airborne incursion of GM canola swathes into Eagle Rest (described by the Marshes in their pleadings and submissions in tendentious fashion as a 'contamination')" (Martin, 2014, p.15). The failure to cross this necessary rubicon was fatal to the case.

It became legal to grow GM canola in WA in January 2010 and Baxter immediately took

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up the option to plant a crop. Subsequently: “Mr Marsh then describes the asserted 'contamination' of a number of the Eagle Rest paddocks in late November/early December 2010, by a discovered presence of some 245 cut GM canola swathes which he found scattered across some Eagle Rest paddocks (Martin, 2014, p.81).

Marsh notified his organic certifier the National Association for Sustainable Agriculture Australia (NASAA) and its certification arm NASAA Certified Organic (NCO): “Mr Marsh's first communication to Ms Goldfinch told her there was 'substantial contamination' from 'neighbours swathed GM Canola crop ... up to 800 metres inside the boundary'. His second fax revised this to 'an area up to 1.2km from GM boundary into our property by 1.6km wide ... approximately 160 Ha', including 'hundreds of swathed GM plants and thousands of seeds spread across our land'” (Martin, 2014, p.25).

Following on from those faxes from Marsh: “According to documentation produced in December 2010 by the senior executive certification decision-maker for NCO (Ms Stephanie Goldfinch), NASAA standard 3.2.9 was invoked to support first the initial suspension, then the decertification of Eagle Rest paddocks 7 - 13. Those paddocks were assessed by NCO as being 'contaminated' by GMOs, raising the underlying question as to what actually had constituted the 'contamination,' for the purposes of the National Standard and the NASAA standards” (Martin, 2014, p.48).

The decertification of most of the Marsh farm followed: “NCO's suspension (on 10 December 2010) of paddocks 7 - 10, 12 and 13 of Eagle Rest, was followed (on 29 December 2010) by the decertification of those same paddocks plus paddock 11 (in all, approximately 70% of the area of Eagle Rest). This contractual sanction was imposed by NCO, on the basis of Eagle Rest's then asserted 'contamination by [Genetically Modified Organisms]'. Unhelpfully, there is no definition of 'contamination' or of 'genetic contamination' found in the NASAA standards or, for that matter, in the National Standards” (Martin, 2014, pp.47-48), whereas contamination is “defined in IFOAM standards as: Contact of organic product or land with a substance prohibited for organic production or handling” (p.58).

The Judge declared that: “Much of the difficulty for Ms Goldfinch (and for that matter for Mr Marsh) seemed to stem from the fact that the term 'contamination' is not defined in the National Standards or in the NASAA standards. Hence, a hypothetical example put to Ms Goldfinch of a GM canola swathe transiently landing on a sheep's back as effectively a source of contamination of the sheep produced interesting evidence” (Martin, 2014, p. 118). It is tempting to speculate that if there was an ‘incursion’ of sand into the judge’s favourite breakfast spread might he perhaps determine that his vegemite, or whatever, was indeed contaminated - without reference to a dictionary, a definition or a standard?

However, as the Judge declared: “courts resolve litigation exclusively on the basis of the state of the evidence led before the court ... In this trial, the Marshes did not prove or even seek to prove that a swathed canola plant with attached seed pods and with viable canola seed in the seed pods is in any way toxic, harmful or otherwise dangerous to humans, animals or to land. No evidence was led to that end. The trial evidence was overwhelmingly the other way ... it was not contended in this trial that any adverse physical consequences had ever been suffered by humans, animals or by the land (ie, at Eagle Rest) by reason of the airborne incursion on the wind of approximately 245 GM

canola swathes, which I have found were blown into some Eagle Rest paddocks from Sevenoaks, in late November or early December 2010" (Martin, 2014, pp.130-131).

The story of Marsh v. Baxter is part of a greater narrative of what Northbourne (1940, p. 81) characterised as the contest of "organic versus chemical farming". In his manifesto of organic agriculture, Northbourne had warned that "It is a task for generations … And those engaged will be fighting a rearguard action for many decades, perhaps for centuries" (1940, p.115). There is at least one solid precedent (Murphy v. Butler, 1960) where an expensive legal case was mounted by organic/biodynamic farmers (Marjorie Spock and Mary Richards, of Long Island, New York), lost in the courts of law, but subsequently won in the court of public opinion (Paull, 2013b). In that case, the expert witness testimony and the data generated by Spock and Richards were reformulated by Rachel Carson to produce *Silent Spring* (1962). The present case leaves less scope for such an approach since as the judge observed: "I will also record that there was also a high measure of agreement at the trial between the six expert witnesses called in aggregate for both sides" (Martin, 2014, p.14).

Marsh v. Baxter offers no assurance for the possibility of coexistence of GMO and organic farming in Western Australia, it offers no protection for organic farmers, it places no constraints on GMO farmers. For the organic sector the case sets an unfortunate precedent. It provides a case study prescription of how to contaminate an organic farm with GMO material with impunity (at least in this case): plant GMOs on the boundary of an organic farm, upwind of the organic fields, instead of direct harvesting the seeds, swathe the plants and let them drop, and await the next prevailing wind to disperse them.

Marsh v. Baxter has been the most expensive legal case mounted in Australia by the organics sector. Unfortunately the results, to date, are not just unproductive, they are counterproductive. An appeal against the decision is possible. Marsh has regained his organic certification.

Dr. John Paull
Editor-in-chief

References

Carson, R. (1962). Silent Spring (Readers Union 1964 members' edition). London: Hamish Hamilton.

Martin, K. (2014). Judgement: MARSH -v- BAXTER [2014] - WASC 187BC201302729; CIV 1561/2012. Perth: Supreme Court of Western Australia.

Murphy v. Butler. (1960). Murphy et al. v. Butler, Area Supervisor, Plant Pest Control Division of the Agricultural Research Service, United States Department of Agriculture, et al. Supreme Court of the United States: Murphy v. Butler, 362 U.S. 929 (U.S. 1960).

NASAA. (2012). NASAA Organic Standard. Stirling, SA: National Association for Sustainable Agriculture Australia (NASAA).

Northbourne, Lord. (1940). Look to the Land. London: Dent.

Paull, J. (2013a). A history of the organic agriculture movement in Australia. In B. Mascitelli & A. Lobo (Eds.). Organics in the Global Food Chain (pp. 37-60). Ballarat: Connor Court Publishing.

Paull, J. (2013b). The Rachel Carson letters and the making of Silent Spring. Sage Open, 3(July-September), 1-12.

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Attitudes of agricultural extension workers towards organic farming in Iran

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Abstract

The purpose of this study was to investigate and analyse the attitudes of agricultural extension workers towards organic farming in Kermanshah Township, Iran. The statistical population in this study consisted of all agriculture extension workers of Jihad-e-Agriculture management and centres of agricultural services in Kermanshah Township (N=148), of whom 123 were available and provided data for this study. The main instrument in this study was a questionnaire, administered face to face in the Persian language, comprising 20 statements pertaining to organic agriculture (adapted from a study by Chouichom & Yamao, 2010) along with demographic questions and sources of information questions. The 20 statements covered organic farming knowledge (7 items), environmental aspects (5 items), marketing aspects (4 items), costs and benefits (4 items), which were rated by respondents on a five point Likert response scale (from 1=entirely agree through to to 5=entirely disagree). Results showed that the attitude of the agricultural extension workers toward organic farming was at the neutral to negative level. There were no differences in attitude based on age, gender, marital status, work experience, level of education (bachelor versus masters degree), or amount of time reading newspapers. Those with studies in agriculture were more negative towards organic agriculture than those with backgrounds in other fields. The attitudes to organic farming were more favourable (or less negative) for respondents who used more data sources, used the internet more, read more science magazines or read more scientific research journals. It is concluded that, in general, more informed agricultural extension workers will express more favourable attitudes towards organic farming. The results indicate that agricultural extension workers could be supplied with more information about organic farming and perhaps specialist organic agriculture extension workers would facilitate the faster uptake of organic farming in Iran.

Keywords: Sustainable agriculture, organic farming, agricultural extension.

1 Introduction

Iran lags behind most countries in the uptake of organic agriculture, and reports 42,634 hectares of certified organic agricultural land (0.09% of its agricultural land) and 38,035 hectares of organic wild collection area (Willer & Lernoud, 2014). Globally, 0.86% of agricultural land is managed organically (Willer & Lernoud, 2014). Globally, the total of organic agriculture hectares has been increasing at a compound rate of 8.9% per year over the past decade, and rapid rates of increase have been witnessed, led by Uruguay

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(with a x716 increase in organic agriculture hectares over the past decade), India (x689), Philippines (x553), and China (x214) (Paull, 2011). Agricultural extension workers have a role to play in the uptake of organic farming practices (Yadav et al., 2013). This paper examines the attitudes to organic farming of agricultural extension workers in a region of Iran.

Today's agricultural systems are heavily dependent on chemical inputs (Hatirli et al., 2005) and generally there is an abundance of food (Saghafi et al., 2010). But there have been widespread environmental negative outcomes associated with the increasing application of synthetic chemicals, including the contamination of soil and water supplies, a proliferation of pests and and novel types of plant diseases, malnutrition and a decrease in the food supplies quality (Kivani & Liaghati, 2007). The combination of these factors mean that the environmental care and the health and safety of food supplies could become one of the most significant issues of the day and has made international human communities try to find solutions to face these issues and achieve sustainable agricultural systems (Mafi, 2008).

Organic farming is a solution that addresses the issues of the deleterious effects of chemical farming (Kings & Ilbery, 2012) and is increasingly accepted by countries and different international organizations of the world. Many countries are interested in organic farming system and organic products to avoid environmental contaminations and to foster health (Grossman, 1972). Organic farming systems offer a solution to counter the destructive effects of the prevalent farming systems (Dunlap & Beus, 1996; Dickinson & Abaidoo, 2003; Dimara et al., 1986; Dahlberg, 1990).

Organic farming is one of the sustainable agricultural systems and relies less on expensive imports such as chemical fertilizers and pesticides (Ramesh et al. 2005). In organic farming, synthetic chemical fertilizers and pesticides are excluded, along with genetically modified organisms, X-radiation, and manufactured nanomaterials. Organic farming is a coherent, organized and humanized system which advances the health development of environmental ecosystems, biological soil activities and living cycles, by the application of existing sources of the farm. Organic farming brings a modern and scientific attitude to the traditional farming that our ancestors used to perform (Abdollahi, 2008).

Organic agriculture is a production system which excludes application of synthetic fertilizers, synthetic chemical pesticides, herbicides, and fungicides, and advocates composting, crop rotation, fallow rests, and biological controls to maintain the equilibrium. The main purpose of these methods is to create a production system which forms a constructive, appropriate equilibrium among the humans, soils, plants and animals in the system and does not have any contradiction with the human and environmental interests (Asadi & Naderi Mahdiei, 2009). Most of the organic farming activities like the use of nitrogen stabilizer plants, returning agricultural wastes to the soil, and application of covering plants would result in an enhancement of return of carbon to the soil and would help preserve and storing it in the soil.

Despite the advantages of organic farming, statistics show that the international rate of application of chemical fertilizers has more than doubled between 1950 and 1996 (Akbari & Asadi, 2005). In Iran during the years of 2003 & 2004 about 4.1 tons of different kinds of fertilizers were distributed among farmers (Babaakbari & Mobahedian, 2006). It seems

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to be imperative for Iran to adopt and develop organic farming systems. Kermanshah Township could be a pioneer in Iran's organic agriculture and can greatly contribute to the country economically. Laying the groundwork for progress in agriculture in this Township can be regarded as an imperative for the improvement of the whole country's progress in sustainable agriculture (Purjavid et al., 2011). The question is how can we persuade the farmers to adopt the organic farming methods? Wheeler (2005) believes that the rate of the uptake by the farmers is affected by these elements: their perception of "risk measurement", profit and innovation advantages; the reliability or un-reliability the innovation; the amount of the information that the farmer needs to know about the innovation: the farmer's attitude toward "risk" and "un-confidence".

The existing information about an innovation is a significant and influential factor for the farmer to adopt an innovation. This information can be transmitted to the farmers by different means. Information sources of the farmers include extension workers, scientists, researchers and the graduates of universities. Researchers have mentioned the significant role of the extension experts in their studies about the introduction of the agricultural innovations among farmers (e.g. Fuglie & Kascak, 2001; Marsh et al., 2000; Kromm & White, 1991; Van den Ban & Hawkins, 1988; Feder & Slade, 1984).

Some studies have indicated that those who have implemented organic farming have been complaining about the negative attitude of the extension experts toward organic farming and their lack of knowledge and they have even mentioned that these experts had been frustrating other farmers in their uptake of organic farming practices (Morgan & Murdoch, 2000; Harp & Sachs, 1992; Busch & Lacy, 1983).

Generally it can be regarded that one's activities in any field are the manifestation of one's attitudes toward it and these attitudes consist of a combination of complex beliefs, motivations and experiences (Fishbein & Ajzen, 1975). An attitude can be identified as a tendency to answer to an idea or situation in a particular way which is mostly considered as a concept to guide individual's behaviour (Grossman, 1972). The attitudes of the extension workers of the Kermanshah Township toward organic farming is studied in this research. Wheeler (2005) has reported factors affecting on the attitude of the extension experts toward organic farming and biotechnology. He concluded that like other people, the decision making of the extension workers is not merely dependent to the scientific results about the technologies and novel innovations of the scientists and researchers. The advocacy of innovations by agricultural experts, particularly extension workers, is not independent of their own values and beliefs. That study also indicated that factors including knowledge, experience, educational degrees, available information and the attitude toward sustainable agriculture would have an effect on the attitude of the agricultural extension workers toward organic farming and any other innovation.

In another study, Wheeler (2008) concluded that a greater level of knowledge of the agricultural experts about sustainable agriculture would enhance positive outcomes toward that system. Khaledi et al. (2007) indicated in his research that farmers do not have enough information about organic farming, and that organizations which are connected to the organic farming sector can provide them with appropriate information. It can be inferred that agricultural extension workers are a significant source that can provide farmers with information. However, the experts transmit the information to the farmers according to their own attitude. So, in order to advocate organic farming to the farmers and extending this agricultural system as one of the sustainable agricultural

systems, it is important to recognize the attitude of the extension experts of agriculture and the effect on developing organic agricultural systems among the farmers.

To advance the uptake of organic agriculture, it is important to improve agricultural extension expert's attitudes toward organic farming as a sustainable agricultural system which contributes to protect the environment, to achieve abundant food supplies and sustainable agricultural practices. Unfortunately, existing evidence indicates the lack of uptake of organic agricultural system among the farmers of Iran, therefore, we have made our attempt to analyze the attitude of the agricultural extension experts of Kermanshah Township as the pioneer of the countries' agricultural system, toward the organic farming. The results of this study could provide managers and legislators of agricultural improvement with some indications and proposals. Results emerging from this study may be utilized to create plans to improve the attitude and knowledge of the agricultural extension experts toward organic farming that would bring about the extension of this agricultural system among farmers.

The purpose of this study is to investigate and analyze the attitude of agricultural extension experts toward organic farming with the view to achieving: a description of the personal and professional characteristics of agricultural extension experts; a validation of the measurement model of attitude toward organic farming among the agricultural extension experts; a reporting of the attitudes of the agricultural extension experts toward organic farming; an understanding of the attitude of agricultural extension experts toward organic farming based on the variables of the study; an examination of the relationship between the variables of the study and the attitude of the respondents toward organic farming; and determining factors affecting respondent’s attitudes toward organic farming.

2 Material and methods

The statistical population for this study consisted of all agricultural extension workers of Jihad-e-agriculture management and agricultural central services of Kermanshah Township (N=148) and of these 123 workers responded to the questionnaire. The instrument of this research was a questionnaire, administered face to face in the Persian language, which consisted of two parts: (a) personal and professional characteristics of the extension experts; and (b) their attitudes toward organic farming. In the second part of the questionnaire we adapted the 20 attitude measurement items reported by Chouichom & Yamao (2010). The 20 attitude items about organic farming comprised items addressing the organic farming knowledge aspect (OFKA, 7 items), environmental aspects (EA, 5 items), marketing aspects (MA, 4 items), and cost and benefit aspects (CBA, 4 item) (Chouichom & Yamao, 2010) (Table 2). The 20 statements were each rated by respondents using a five step Likert scale (from 1=entirely agree, to 5=entirely disagree); note that this is the reverse of the rating system used by Chouichom & Yamao (2010). In order to refine the content of the questionnaire there has been some reformation based on the viewpoints of some professors and Ph.D. students of the Rural Extension and Development Department of Razi University and experts of agricultural research organizations in Kermanshah Province, and also there has been some other reformation of the items of the questionnaire regarding the consideration of respondent comprehensibility in the pilot stage of this research. In order to validate the internal consistency of the instrument of the research the Cronbach's alpha coefficient was determined. To analyze the data by both descriptive and inferential statistics LISREL8.54 and SPSSwin20 were applied. LISREL software was applied for the confirmatory factor

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analysis and SPSS software was applied to describe the variables of the research and analyzing the relations among them.

3 Results and discussion

3.1 Personal and professional characteristics of the agricultural extension experts

The mean age of the agricultural extension experts (N=123) in this study is 37.20 years (with the standard deviation of 12.04 years) and their work experience mean is 15.63 years (with the standard deviation of 9.55 years). The majority of the agricultural extension experts were men (73.6%) and 32 of them (26.4%) were women. The majority of respondents are married (64.5%) and only 43 of them (35.5%) were single. The educational level of the majority of the agricultural extension experts were B.A (82.6%), and only 19 were M.Sc. (17.4%). The majority of respondents had graduated with an agricultural major (73.5%) and 31 people (36.5%) had graduated from other majors. Personal and professional characteristics of the agricultural extension experts are presented in Table 1.

Table 1. Personal and professional characteristics of the agricultural extension workers.

Variable	mean	Standard deviation	Minimum	maximum
Age (years)	37.20	12.04	20	55
Work experience (years)	15.63	9.55	1	31
Number of information sources	3.20	1.48	1	6
Internet usage (hours per day)	3.42	2.34	0	8
Paper reading (hours per week)	3.08	1.91	1	12
Reading science magazines (hours per week)	5.01	2.50	1	10
Reading scientific-research journals (hours per week)	8.18	5.41	0	20
Watching TV (hours per week)	19.72	5.37	9	32

3.2 The attitudes of the agricultural extension workers toward organic farming

The mean attitudes of the agricultural workers are reported in Table 2. Of the 20 items of the instrument, most items (n=17) were rated in the negative (disagree) zone (i.e >3.00) and a few (n=3) were rated in the positive (agree) zone (i.e. <3.00). Of the four aspect clusters, three (OFKA, EA & MA) were rated in the negative (disagree) zone (i.e >3.00) while one (CBA) was rated in the positive (agree) zone (i.e. <3.00) (Table 2). In general, the attitudes of the agricultural extension experts of Kermanshah Township is not favourable toward organic farming (Table 2).

Table 2. Attitudes toward organic farming (N=123).

Aspect/Item	mean*	S.D.	C.V.	Priority**
Organic farming knowledge aspect:	**3.42**	**0.69**	**-**	**-**
Organic farming is more complicated than chemical farming	3.55	1.10	0.338	7
Organic farming needs preliminary soil nutrition	3.48	0.93	0.267	2
Adoption of organic farming brings about environmental cleanliness	3.27	0.82	0.251	1
You have to utilize quality seeds from valid sources in organic farming	3.25	1.02	0.314	6
It is essential to provide the soil with organic fertilizers in organic farming	3.46	1.05	0.303	4
Organic farming does not need synthetic pesticide application	3.58	1.03	0.288	3
Organic farming is the application of innovations compatible to the local issues	3.55	1.08	0.304	5
Environmental aspect:	**3.33**	**0.65**	**-**	**-**
Organic farming brings about improvements in soil features	3.16	0.73	0.231	1
Organic farming protects natural resources in comparison with chemical farming	3.48	0.82	0.236	2
Organic farming does not give off toxic gases	3.62	0.93	0.257	3
Organic fertilizers utilized in the farms do not endanger the farmer's health	3.19	0.84	0.263	4
Chemical farming damages natural resources next to the farms	3.17	0.85	0.268	5
Marketing aspect:	**3.25**	**0.59**	**-**	**-**
Consumers are prefer to purchase organic farming products than chemical farming products	3.23	0.74	0.229	2
-Consumers can easily buy organic products from the farms	3.32	0.69	0.208	1
Government support the production of organic farming products more than that of chemical farming products	3.22	0.74	0.230	3
Organic farming product marketing is easier than that of chemical farming product marketing	3.24	0.73	0.235	4
Cost & benefit: aspect	**2.95**	**0.63**	**-**	**-**
Generally, the production of organic farming products would cost more than that of chemical farming products	2.88	0.93	0.323	4
Production of organic farming products is more beneficial than chemical farming products	2.94	0.80	0.272	2
Organic farming reduces costs by using organic fertilizers and family participation on farm	2.95	0.90	0.305	3
Consumers pay more for organic products	3.03	0.77	0.254	1
Attitude (General):	**3.27**	**0.46**	**-**	**-**

*Likert scale: 1=entirely agree; 2=agree; 3=neither agree nor disagree; 4=disagree; 5=entirely disagree.
** Ranking based on the Coefficient of Variation (C.V. = S.D/mean).

3.3 Attitudes of the extension workers based on demographic variables

The attitudes of the agricultural extension experts of the Kermanshah Township toward organic farming, based on the three variables of gender, marital status and academic field is reported in Table 3.

Table 3. The attitudes of agricultural extension experts toward organic farming based on gender, marital status and academic field.

Dependent variable	Independent variable	Levels	F	mean	S. D.	t	Sig.
Attitude	Gender	Male	89	3.33	0.41	1.877	0.067
		Female	32	3.12	0.56		
	Marital status	Married	78	3.30	0.50	0.738	0.462
		Single	43	3.23	0.39		
	Academic field	Agricultural	86	3.35	0.42	2.904**	0.004
		Other	31	3.07	0.51		

**p<0.01

There was no significant statistical differences among the attitudes of the experts toward organic farming on the basis of gender or marital status. In other words, it is shown that women and men, single and married experts have comparable attitudes toward organic farming. However, there was a significant difference among the attitudes of the experts toward organic farming based on their academic field. The attitudes of those who had studied in a field other than agriculture were more positive than those whose studies were in agriculture. There was no statistical significant difference based on the academic level achieved (B.Sc. or M.Sc.) in the attitudes of the experts toward organic farming.

3.4 The relationship between the variables of the study and the attitudes of the respondents

Results shown in Table 4 indicate that there is no significant statistical relationship between the variables of age, work experience, and the rate of newspaper reading and the attitude of the agricultural extension experts of Kermanshah Township toward organic farming (using Pearson's r). For five variables there is a positive relationship (Table 4).

Using more sources of data, using the internet more, reading more science magazines, reading more scientific research journals, and even watching more TV were all associated with more favourable attitudes to organic farming (Table 4). These results suggest that the more information that extension workers are exposed to, especially via the internet and science research journals, the more positive will be their attitudes to organic farming.

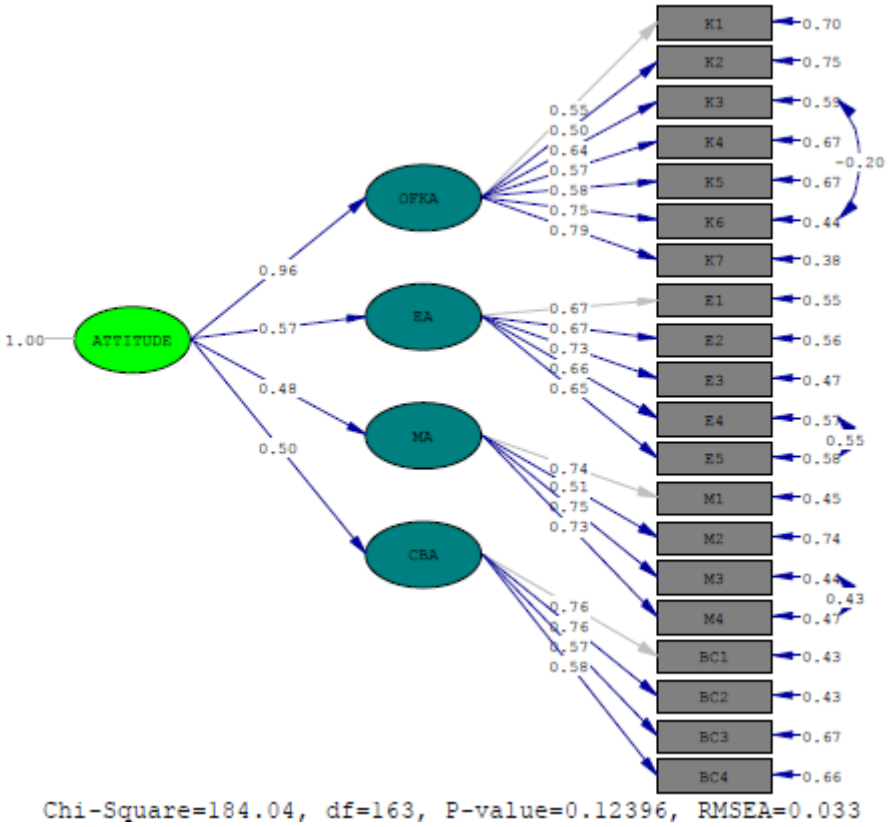
Table 4. The relation between the attitude of the respondents toward organic farming and the studied variables.

Variables	Attitude toward organic farming	
	r	Sig.
Age	-0.072	0.434
Work experience	-0.081	0.409
Number of data sources	0.434**	0.000
Internet usage	0.370**	0.000
Newspaper reading	0.150	0.110
Reading science magazines	0.286*	0.012
Reading scientific research journals	0.537**	0.000
Watching TV	0.224*	0.017

**p<0.01 and * p<0.05

3.5 Internal consistency of the model of attitudes toward organic farming

In order to determine the internal consistency of the measurement model of attitudes toward organic farming which consists of organic farming knowledge aspect (OFKA), environmental aspect (EA), marketing aspect (MA) and cost and benefit aspect (CBA), confirmatory factor analysis was applied by the use of LISREL software. The measurement model of attitudes toward organic farming with the standardized factor loads and fitting indices are presented in Model 1 with the significance levels presented in Table 5 based on the second-order confirmatory factor analysis.



Model 1. Measurement Model of Attitude toward Organic Farming.

Table 5. Significance level and Cronbach's alpha of attitude measurement constructs toward organic farming.

Constructs	Standardized coefficient	Standard error	Meaning level	Cronbach's Alpha
OFKA	0.96	0.19	5.02**	0.81
EA	0.57	0.18	4.32**	0.83
MA	0.48	0.17	3.76**	0.82
CBA	0.50	0.12	4.14**	0.76

** P<0.01

Based on the coefficients of standardized factor loads and fit indexes (Model 1) and the significance level of the indices (Table 5), it is concluded that there is appropriate

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consistency among the data and the factor structure and the theoretical foundation of the measurement model of attitude toward organic farming can be accepted. It is concluded that the application of this model as an appropriate model investigate the attitudes of agricultural extension workers has validity in this study and even future studies.

4 Conclusions

Results of the present study show that agricultural extension experts of Kermanshah Township in general do not have positive attitudes toward organic farming. This can negatively effect them in extending organic farming methods among farmers. The reason of this negative attitude toward organic farming can be a lack of knowledge toward organic farming (Wheeler, 2005).

This study found that better informed and more widely informed respondents have more positive attitudes towards organic farming. Those extension workers with education in a field other than agriculture, those who use a broader range of information sources, those who use the internet more, those who read more science magazines or scientific research journals all express more positive attitudes towards organic farming.

These results suggest that encouraging agricultural extension workers to study and read more widely (science magazines and journals, not newspapers) and research on the internet would favour organic farming. Educational courses and in-service training specifically targeted at disseminating organic farming knowledge would be a direct way of, at least, enhancing the received knowledge of extension workers. In the case of new recruitment a priority might be to recruit those with an education broader than just agriculture and who have demonstrated research skills.

Since the variables of reading science magazines and using the internet have been revealed here to be influential factors on the attitude of the experts of this study it is suggested to provide the extension workers with magazines including the introduction of latest agricultural innovations and modern methods of farming, and perhaps also establishing internet websites tailored to their need that would provide the experts with new articles in their fields for free, or at least make them well aware of the largest free depository and data base of organic agriculture research: <http://www.orgprints.org>.

References

Abaidoo, S. & Dickinson, H. 2002. Alternative and conventional agricultural paradigms: Evidence from farming in southwest Saskatchewan. Rural Sociology, 67 (1): 114-131.

Abdollahi, S. 2008. Study of Perspective of development of organic forming. Planning and Agricultural Economics Research Institute, No. 51, pp. 24-35.

Akbari, M. & Asadi, A. 2005. Some of the modern agriculture in soil and environments. Proceedings of Soil, Karaj.

Asadi, A. & Naderi Mehdiei, K. 2009. Sustainable Agriculture. Tehran: Payame-Nour University.

Babaakbari, M. & Movahedian, M. 2006. Improvement fertilizer consumption with regard to country budget laws. Proceedings of the 10th soil science in Iran, Karaj.

Baumgartner, H. & Homburg, C. 1995. Applications of structural equation modeling in marketing research: A review. International Journal of Research in Marketing, 13, 139–161.

Beus, C. & Dunlap, R.E. 1990. Conventional versus alternative agriculture: the paradigmatic roots of the debate. Rural Sociology, 55 (4): 590-616.

Busch, L. & Lacy, W. 1983. Science, agriculture and the politics of research. West view Press Inc, Boulder.

Chouichom, S. & Yamao, M. 2010. Comparing opinions and attitudes of organic and non-organic farmers towards organic rice farming system in North-Eastern Thailand. Journal of Organic Systems, 5 (1): 25- 35.

Dahlberg, K.A. 1986. New Directions for Agriculture and Agricultural Research: Neglected Dimensions and Emerging Alternatives. Rowman & Allanheld Publishers, New Jersey.

Dimara, E., Petrou A. & Skuras, D. 2003. The socio-economics of niche market creation: A social ecology paradigm for the adoption of organic cultivation in Greece. International Journal of Social Economics, 30 (3): 219-235.

Feder, G. & Slade, R. 1984. The acquisition of information and the adoption of new technology. American Journal of Agricultural Economics, 66 (3): 312-320.

Fishbein, M. & Ajzen, I. 1975. Belief, Attitude, Intention, and Behavior: An introduction to theory and research. J. Wiley and Sons: New York, USA.

Fuglie, K. & Kascak, C. 2001. Adoption and diffusion of natural-resource-conserving agricultural technology. Review of Agricultural Economics, 23, (2): 386-403.

Gangadharappa, H. V., Pramod, K.T.M.,& Shiva, K.H.G. 2007. Gastric floating drug delivery systems: a review. Indian J. Pharm. Ed. Res. 41, 295-305.

Grossman, M. 1972. On the concept of health capital and the demand for health. Journal of Political Economy, 80 (2): 223-255.

Harp A. & Sachs C. 1992. Public agricultural researchers: Reactions to organic, low input and sustainable agriculture. Agriculture and Human Values, 9 (4): 58-63.

Hatirli, S. A. Ozkan, B. and Fert, K. 2005. An econometric analysis of energy input/output in Turkish agriculture. Renewable and Sustainable Energy Reviews, vol. 9, 608-623.

Khaledi, M. Gray, R. Weseen, S., & Sawyer, E. 2007. Assessing the barriers to conversion to organic farming: an institutional analysis. Submitted to: Advancing Canadian Agriculture and Agri-Food Saskatchewan (ACAAFS).

Kings, D. & Ilbery, B. 2012. Farmers' attitudes towards organic and conventional agriculture: a behavioural perspective. Organic Food and Agriculture - New Trends and Developments in the Social Sciences, Dr Matthew Reed (Ed.), ISBN: 978-953-307-764-2, In Tech, Available from:http://www.intechopen.com/books/organic-food-and-agriculture-new-trends-and-developments-in-the-socialsciences/farmers-attitudes-towards-organic-and-conventional-agriculture-a-behavioural-perspective

Krejcie, R. V. & Morgan, D. W. 1970. Determining sample size for research activities. Educational and Psychological Measurement, 30, 607-610.

Kiyani, G.H.. & Liyaghati, H. 2007. Analysis of economic conditions current agricultural conversion to organic farming by using dynamic linear programming model. 2nd National Congress of Ecological Agriculture, Gorgon, Iran.

Kromm D. & White S. 1991. Reliance on sources of information for water-saving practices by irrigators in the high plains of the USA. Journal of Rural Studies, 7 (4): 411-421.

Marsh, S. Pannell, D. & Lindner , R. 2000. The impact of agricultural extension on adoption and diffusion of lupines as a new crop in WA. Australian Journal of Experimental Agriculture, Vol. 40, pp. 571-583

Mafi, H. 2008. Organic Farming. Available at: www.crop.blogeky.com

Morgan, K. & Murdock J. 2000. Organic vs. conventional agriculture: knowledge, power and innovation in the food chain. Geoforum 31 pp. 159-173.

Mohammadi, M. 2007. Organic farming. Available at: http://ea–nazer.blogfa.com

Paull, J. 2011. The uptake of organic agriculture: A decade of worldwide development. Journal of Social and Development Sciences, 2(3), 111-120.

Pourjavid, S. Alibaygi, A. & Zarafshani, K. 2011. Predictors of teaching efficacy secondary vocational agricultural schools teachers in Kermanshah Township. Agricultural Education Administration Research, No. 17, 67- 80.

Ramesh, P., Singh, M. & Subba Rao, A. 2005. Organic farming: Its relevance to the Indian context. Current Science, 88: 561-568.

Shook, C. L., Ketchen, D. J. Jr., Hult, G.T.M. & Kacmar, K.M. 2004. An assessment of the use of structural equation models in strategic management research. Strategic Management Journal, 25, 397–404.

Van den Ban, A. & Hawkins H. 1988. Agricultural Extension, Longman Scientific & Technical, Essex.

Wheeler, S. 2005. Factors influencing Agricultural professionals' Attitudes Towards Organic Agriculture and Biotechnology.

Wheeler, S. 2008. What influences agricultural professionals' views towards organic agriculture? Ecological Economics, 65: 145-154.

Willer, H., & Lernoud, J. (Eds.). (2014). The World of Organic Agriculture: Statistics and Emerging Trends 2014: Frick, Switzerland: Research Institute of Organic Agriculture (FiBL) & Bonn: International Federation of Organic Agriculture Movements (IFOAM).

Yadav, D. S., Sood, P., Thakur, S. K., & Choudhary, A. K. (2013). Assessing the training needs of agricultural extension workers about organic farming in the North-Western Himalayas. *Journal of Organic Systems,* 8(1), 17-27.

Direct, residual and cumulative effects of organic manures and biofertilizers on yields, NPK uptake, grain quality and economics of wheat (*Triticum aestivum* L.) under organic farming of rice-wheat cropping system

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Abstract

Field experiments were conducted at the research farm of the Indian Agricultural Research Institute, New Delhi during rabi (winter) season of 2007-2008 and 2008-2009 on a sandy clay loam soil (typical Ustochrept, 51.46% sand, 23.02% silt and 25.52% clay) of low in organic C (0.57%), medium in available phosphorus (19.87 kg/ha), high in available potassium (247.12 kg/ha) and low in available nitrogen (163.2 kg/ha) and of pH 8. Results revealed that the cumulative effects of farmyard manure (FYM) and green manure (GM) were more effective than their direct and residual effects and GM was significantly superior to FYM for increasing the productivity, nutrient uptake, grain quality and gross and net income of wheat in the rice-wheat cropping system. Further, inoculation of biofertilizers (B) with GM was better than GM alone in its cumulative effect. The combination of GM + FYM was still better than GM or FYM alone in its direct and cumulative effects for increasing productivity and gross return, but net return was significantly reduced due to the higher cost of GM + FYM compared to FYM or GM alone. However, the residual effect of GM + FYM was similar to the cumulative effects of GM or FYM alone. The highest increase in productivity, grain quality and nutrient uptake was recorded with the application of GM + FYM + B. However, net return was significantly reduced due to the higher cost incurred in the combination of GM + FYM + B. It was concluded that the cumulative effect of GM + FYM + B for higher productivity and the cumulative effect of GM + B for higher net return were suitable for wheat in organic farming of the rice-wheat cropping system.

Keywords: Wheat, yields, NPK, grain quality, organic farming, gross and net return.

Introduction

Wheat (*Triticum aestivum*) is the second most important food crop in India (after rice) and occupies about 26.7 million hectares of area and contributes about 33.9% of the total food grain production in India. The rice-wheat cropping system covers 10 million ha representing 75% of the total rice area and 63% of the total wheat area in India (Mishra 2009). This signifies the important contribution of wheat in meeting the food requirements

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of the country. The production of rice and wheat in a rotation is, however, facing a sustainability problem due to some practices of the modern production system with its indiscriminate use of chemical fertilizers and pesticides (Nambiar 1994, Duxbury et al. 2000, Ladha et al. 2000, Yadav et al. 2000, Prasad 2005).

The adverse effects of agro-chemicals are clearly visible on soil structure, microflora, quality of water, food and fodder. The quality of the produce is deteriorated due to the entry of chemical residues in the plant body and then to the food chain. The concerns such as declining factor productivity (Biswas & Sharma 2008; Patil 2008; Yadav 1998; Yadav 2008), depletion of soil organic carbon and mineral nutrients (Prakash et al. 2008), waterlogging and salinization, increasing nitrate concentration in well water (Singh et al. 1995), are the consequents of the modern rice-wheat production system with its unbalanced and injudicious use of chemical fertilizers and pesticides. The emerging scenario necessitates the need for the adoption of practices which maintain soil health, makes the production system more sustainable, and provides quality food for meeting the nutritional requirements.

Organic farming is one of the practices to make the production system more sustainable without adverse effects on the natural resources and the environment (Stockdale et al. 2001; Ram et al. 2011a) and over the past decade India has exhibited a rapid uptake of organic farming (second only to Uruguay) (Paull, 2011). The application of ample amounts of organic manure is the key for success of organic farming (Swift and Woomer 1993). The role of biofertilizers for enhancing the productivity of soil by fixing atmospheric nitrogen, or by solubilising soil phosphorus, or by stimulating plant growth through synthesis of growth promoting substances has special importance in organic farming. Previous studies by Davari et al (2012) and Ram et al (2011b) reported where a package of different organic nutrient sources (FYM, crop residue, biofertilizers and vermicompost) and its combinations were tested for fulfilling the need of nutrients for wheat via organic sources. The present paper implements different treatments and is aimed at comparing the direct, residual and cumulative effects of different combinations of organic manures (including green manure) and biofertilizers to find out the effect of different combinations of organic manures and biofertilizers on yields, NPK uptake, grain quality and gross and net returns of wheat under organic farming.

Materials and Methods

Site and soil

Field experiments were conducted at the Research Farm of the Indian Agricultural Research Institute, New Delhi (77°10'N latitude; 228.4 m above mean sea level) during the rabi seasons (December to April) of 2007-08 and 2008-09. The soil of the experimental field was sandy-clay loam, alkaline in reaction (pH 8.0), low in organic carbon (0.57 per cent; Walkley and Black method, Prasad et al. 2006), low in available nitrogen (163.2 kg ha^{-1}), medium in available phosphorus (19.87 kg P ha^{-1}) and high in available potassium (247.1 kg K ha^{-1}) in 0-15 cm soil depth at the start of the experiment.

Experimental design and treatments

The experiment was laid out in a randomized block design with three replications and sixteen treatments. Treatments consisted of three sets of five treatments (Farmyard manure (FYM); Green manure (GM); GM + Biofertilizers (B); GM + FYM; and GM + FYM

+ B) and a control. The experiment was carried out in a rice-wheat cropping system and the rice crop was taken before the wheat crop. Hence one set of the treatments was applied to rice which was regarded as direct effect to rice and residual effect to the succeeding wheat. The second set of the treatments was applied to wheat which was regarded as direct effect to wheat and a residual effect to the succeeding rice, and the third set of treatments was applied to both rice and wheat which was regarded as a cumulative effect to both rice and wheat. For green manures, *Sesbania aculeata* (SGM) was used for rice, and Leucaena green leaf manuring (LGLM) was used for wheat. For biofertilizers, blue green algae (BGA) was used in rice, and Azotobacter in wheat. The allocation of various treatments was done by randomization using Fisher and Yates random table (Fisher & Yates, 1963). In tables of results non-significant differences are symbolised as NS.

Farmyard manure was well decomposed and used at 10 t ha^{-1} on a dry weight basis. The nutrient content of organic manures is presented in Table 1.

Table 1. Chemical composition of organic manures.

Composition	FYM				Green manure			
	2007-08		2008-09		2007-08		2008-09	
	Rice	Wheat	Rice	Wheat	Rice	Wheat	Rice	Wheat
Organic C (mg kg^{-1})	143000	138600	139800	140200	386000	460000	389000	481000
Total N (mg kg^{-1})	4800	5000	4900	4900	24000	32000	27000	31500
Total P (mg kg^{-1})	2300	2500	2500	2400	3700	3300	3900	3000
Total K (mg kg^{-1})	4900	5200	5100	5000	20800	23000	21900	22800
Fe (mg kg^{-1})	20.85	22.35	21.9	22	74.6	83.2	77.2	80.3
Zn (mg kg^{-1})	10.6	11.7	12.05	11.9	34.2	36.4	34.8	33.7
Mn (mg kg^{-1})	38.9	39.6	39.95	40.1	88.2	96.2	90.4	94.8
Cu (mg kg^{-1})	2.6	2.7	2.79	2.83	8.5	9.2	8.7	8.8
C:N ratio	29.8	27.7	28.5	28.6	16.1	14.4	14.4	15.3

Sesbania aculeata was grown in the field in plots having the SGM treatment and incorporated *in-situ* after about 60 days of sowing, but before transplanting of rice, with the help of a tractor drawn mould board plough followed by heavy disc. The green lopes of *Leucaena leucocephala* (Subabul) were manually collected by pruning of shrubs planted on the side of Nala (Trench), located near the experimental field and applied at 5 t ha^{-1} on an oven dry weight basis in the plots having the LGLM treatment. It was incorporated into soil with a tractor drawn heavy disc at 20 days before the sowing of wheat. Multani mitti (Fuller's earth) based BGA culture containing four micro-organisms *Aulosira fertilissima, Nostoc muscorum, Tolypothrix tenuis* and *Anabaena variabilies* was obtained from the National Centre for Conservation and Utilization of Blue Green Algae, IARI, New Delhi and broadcasted uniformly at 2.5 kg ha^{-1} in plots having the BGA treatment after 10 days of transplanting of rice. Strains of *Azotobacter chroococcum* specific to wheat was obtained from the Division of Microbiology, IARI, New Delhi, and

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used to inoculate the seeds as per the treatments. Sowing of wheat was done by the *pora* method (sowing with the simplest form of drill consisting of a pipe with a funnel and attached with the plough dropping seeds through (naali) funnels) with the help of a hand plough in the rows spaced at a spacing of 15 cm using a seed rate of 120 kg ha^{-1}. The *pora* method was used because some plots were sown with *Azotobacter* culture treated seed, whereas other plots were sown with untreated seed.

The cost of cultivation of wheat was calculated on the basis of the prevailing rates of inputs, and gross income was calculated on the basis of the price of wheat grain (organic) and the prevailing market price of wheat straw. The net income was obtained by subtracting cost of cultivation from the gross income, i.e.

Net income = gross income – cost of cultivation

The data were analyzed by applying the technique of Analysis of Variance for randomized block design as described by Cochran & Cox (1957). The 15 degrees of freedom for treatments were split into 5 degrees of freedom for 6 combinations of different organic manures and biofertilizers (including the control), 2 degrees of freedom for 3 sets of treatments (i.e. one set of treatments applied to rice, second to wheat, and third to both rice and wheat) and 8 degrees of freedom for the interaction between 5 combinations of the various organic manures and biofertilizers (excluding the control) and 3 sets of treatments.

Results and discussion

Grain and straw yield

The data on grain and straw yield of wheat as influenced by the different combinations of organic manures & biofertilizers and their modes of application are presented in Table 2.

The grain and straw yields were significantly higher with the application of FYM than the control in both the years of study. GM was significantly superior to FYM in increasing grain and straw yields in both the years of study. Both Thakur & Patel (1998) and Singh & Agarwal (2004) have previously reported a beneficial effect of FYM on wheat. The addition of nutrients through GM resulted in significantly higher growth and yield attributes and consequently the straw and grain yield was further more with the application of GM over FYM. Saha et al. (2000) reported a significant increase in growth and yield attributes and yields of wheat due to the application of GM. Inoculation of GM with B resulted in a significantly higher grain and straw yield than GM alone. The application of B in wheat resulted in the addition of 17-20 kg N/ha and some amounts of N can be expected from the residual effect of B applied to the preceding rice crop. Thus the cumulative effect of GM + B proved more effective than GM alone. The application of B significantly increased all the growth and yield attributes and consequently yields were also increased. Apte and Shende (1981), Rabie et al. (1995), Khalid et al. (1997), Khosravi et al. (1998) and Kaushik et al. (2001) have previously reported a significant improvement in growth and yield attributes and yields of wheat by Azotobacter inoculation. Rathore et al. (1995) have reported a residual effect of BGA inoculated in rice on yields of the succeeding wheat. The combination of GM + FYM was significantly better than GM and FYM alone in increasing grain yield and straw yield in both the years of study. The combination of GM + FYM generated significantly higher amounts of nutrients than GM and FYM alone and resulted in significantly higher yields than GM and FYM alone.

Table 2. The effect of organic manures & biofertilizer combinations and modes of application on grain and straw yields of wheat.

Treatment	Grain (t ha^{-1})		Straw (t ha^{-1})	
	2007-08	2008-09	2007-08	2008-09
Organic manures & biofertilizers combination (N)				
Control	2.4	2.4	4.8	4.9
Farmyard manure (FYM)	3.3	3.4	5.6	5.7
Green manure (GM)	3.5	3.8	5.8	6.0
GM + biofertilizers (B)	3.8	4.1	6.1	6.3
GM + FYM	4.3	4.4	6.4	6.5
GM + FYM + B	4.5	4.6	6.5	6.6
Control vs others				
SEd±	0.16	0.19	0.20	0.17
CD (P=0.05)	0.32	0.39	0.41	0.34
Between others				
SEm±	0.08	0.09	0.10	0.08
CD (P=0.05)	0.23	0.27	0.29	0.24
Mode of application (M)				
Direct effect	3.9	4.1	6.2	6.3
Residual effect	3.2	3.3	5.7	5.9
Cumulative effect	4.5	4.7	6.3	6.5
SEm±	0.06	0.07	0.08	0.07
CD (P=0.05)	0.18	0.21	0.23	0.19
N x M				
SEm±	0.14	0.16	0.17	0.15
CD (P=0.05)	0.39	0.47	NS	NS

Across the modes of application, the cumulative effect of nutrient combinations recorded significantly higher yields than direct effect. The direct effect was significantly more than the residual effect of nutrient combinations in both the years of study. The nutrient combinations applied to wheat, as well as to the preceding rice, resulted in improved soil fertility status than nutrient combinations applied to only wheat (direct) or to only preceding rice (residual). Previously Sharma et al. (1995) and Dwivedi & Thakur (2000) also reported that cumulative effects of organic manures were higher as compared to their direct effects.

Interactions between nutrient combinations and their modes of application were not significant in respect to straw yield in either year. Interactions in respect to grain yield (Fig.1) revealed that the effects of FYM and GM were similar in their direct and residual effects, but the cumulative effect of GM was significantly better than FYM in both the years. Inoculation of GM with B resulted in significantly more grain yield than GM (alone) in its direct and cumulative effect but the residual effect was not significant over GM (alone). The combination of GM + FYM was better than the application of either GM or FYM alone. Inoculation of GM + FYM with B did not result in higher grain yield than GM + FYM in its all the modes of applications.

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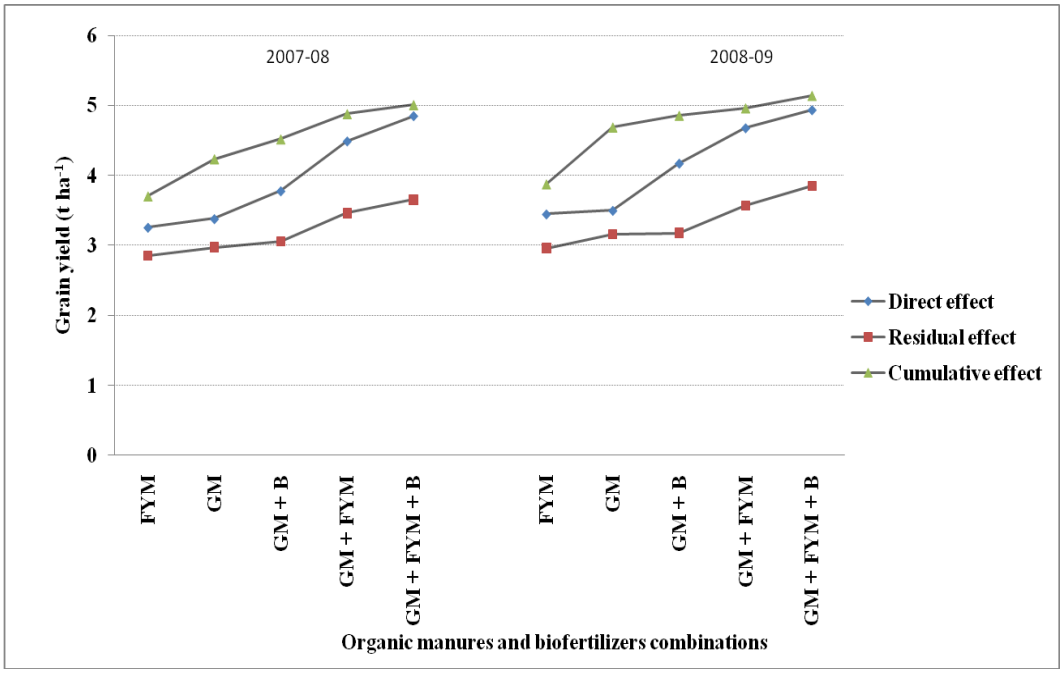

Fig. 1. The interaction effects of organic manures and biofertilizer combinations and modes of application on grain yield (t ha^{-1}) of wheat.

N, P and K uptake

The data on N, P and K uptake by wheat as influenced by the different combinations of nutrients and their modes of application are presented in Table 3. The effects of FYM and GM were similar and significantly higher than the control in respect to the N and P uptake by wheat in the first year of study, whereas in the second year GM resulted in significantly higher N and P uptake than FYM. This may be due to the higher cumulative effect of GM in the second year. In respect to the K uptake, the effects of FYM and GM were similar in both the years of study. Previously Bhardwaj & Tyagi (1994), Ghosh & Shah (1997) and Singh & Agarwal (2004) have reported increased NPK uptake by wheat with FYM application. Inoculation of GM with B showed significantly higher N uptake than GM alone. The P and K uptake was not significantly increased with the application of B with GM in either year of study. The combination of GM + FYM supplied significantly more nutrients and improved soil fertility. Consequently growth and yield were increased significantly and resulted in significantly higher N, P and K uptake than GM or FYM alone.

N, P and K uptake were significantly influenced by the mode of application. The cumulative effect of nutrient combinations resulted in significantly higher N, P and K uptake than the direct effect which in turn was significantly superior over residual effects of the nutrient combinations. These results are explained as due to the higher fertility status of plots receiving nutrient combinations in both the crops (cumulative effect) than those receiving either in wheat (direct effect) or in rice (residual effect).

Table 3. The effect of organic manures & biofertilizer combinations and modes of application on N, P and K uptake by wheat.

Treatment	N uptake (kg ha^{-1})		P uptake (kg ha^{-1})		K uptake (kg ha^{-1})	
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
Organic manures & biofertilizers combination (N)						
Control	43.3	42.6	7.7	7.5	75.6	75.7
Farmyard manure (FYM)	67.3	72.9	12.4	14.9	93.9	98.8
Green manure (GM)	73.2	79.8	13.4	16.4	97.7	103.5
GM + biofertilizers (B)	80.0	86.5	15.0	18.3	102.7	109.6
GM + FYM	91.5	97.0	17.6	20.3	112.2	117.2
GM + FYM + B	97.3	102.7	18.7	22.1	118.5	122.9
Control vs others						
SEd±	4.32	4.25	0.87	0.99	6.4	9.0
CD (P=0.05)	8.81	8.67	1.78	2.03	13.0	18.4
Between others						
SEm±	2.16	2.12	0.44	0.50	3.2	4.5
CD (P=0.05)	6.23	6.13	1.26	1.43	9.2	13.0
Mode of application (M)						
Direct effect	83.6	89.7	15.7	18.6	106.9	110.0
Residual effect	64.9	69.8	11.8	14.4	89.9	94.9
Cumulative effect	97.0	103.8	18.7	22.3	118.2	126.3
SEm±	1.67	1.64	0.34	0.38	2.5	3.5
CD (P=0.05)	4.83	4.75	0.97	1.11	7.1	10.1
N x M						
SEm±	3.7	3.7	0.75	0.86	5.5	7.8
CD (P=0.05)	NS	NS	NS	NS	NS	NS

The interactions between nutrient combinations and their modes of application were not significant in either year of study; this may be due to the relatively short period (2 years) of experimentation.

Grain quality

Nutrient content

The data on N, P and K and micronutrient (Fe, Mn, Zn, Cu) concentrations in wheat grain as influenced by different combinations of nutrients and their modes of application are presented in Table 4. Nutrient content in wheat grain was significantly higher with the application of different nutrient combinations compared to the control. The effect of FYM and GM were similar in respect to nutrient concentration in wheat grain in both the years of study. The inoculation of either GM or GM + FYM with B did not result in a significantly higher concentration of nutrients over GM alone or GM + FYM. The combination of GM + FYM led to significantly higher concentrations of nutrient in wheat grain than GM or FYM alone in both the years of study.

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Across the modes of application, the cumulative effects were not significantly different to the direct effects but resulted in significantly higher concentration of nutrients than the residual effects. There was no significant difference between direct and residual in respect to Mn concentration (in either year) and K concentration (in second year of study). In respect to the P concentration in wheat grain, the cumulative effect was also significantly superior to the direct effect of nutrient combinations. The interactions between nutrient combinations and their modes of application were not significant in either year of study.

Table 4. Effect of nutrient combinations and modes of application on nutrient concentrations in wheat grain

	N, P and K concentration (%)						**Micronutrients concentration (ppm)**							
	N		**P**		K		**Fe**		**Mn**		**Zn**		**Cu**	
Treatment	**2007-08**	**2008-09**	**2007-08**	**2008-09**	**2007-08**	**2008-09**	**2007-08**	**2008-09**	**2007-08**	**2008-09**	**2007-08**	**2008-09**	**2007-08**	**2008-09**
Organic manures & biofertilizers combination (N)														
Control	1.23	1.22	0.254	0.248	0.352	0.351	28.0	27.8	35.2	35.0	33.3	33.1	7.0	6.9
Farmyard manure (FYM)	1.42	1.47	0.304	0.356	0.386	0.400	30.6	30.8	37.8	38.3	37.4	38.0	7.4	7.9
Green manure (GM)	1.46	1.50	0.307	0.360	0.389	0.402	31.9	32.2	37.9	38.7	38.9	39.3	7.5	7.9
GM + biofertilizers (B)	1.48	1.52	0.321	0.374	0.403	0.420	33.4	33.5	38.7	38.8	41.9	42.0	7.6	8.0
GM + FYM	1.55	1.59	0.338	0.387	0.417	0.431	37.1	37.4	39.1	39.4	45.8	46.0	7.6	8.1
GM + FYM + B	1.57	1.61	0.343	0.401	0.425	0.439	37.6	37.9	39.5	39.7	47.5	47.7	7.6	8.1
Control vs others														
SEd±	0.08	0.07	0.018	0.014	0.018	0.021	1.25	1.43	0.91	0.73	2.00	1.88	0.08	0.14
CD (P=0.05)	0.17	0.15	0.037	0.029	0.037	0.042	2.55	2.92	1.85	1.50	4.09	3.85	0.16	0.29
Between others														
SEm±	0.04	0.04	0.009	0.007	0.009	0.010	0.62	0.72	0.45	0.37	1.00	0.94	0.04	0.07
CD (P=0.05)	0.12	0.11	0.026	0.020	0.026	0.030	1.80	2.07	1.31	1.06	2.89	2.72	0.11	0.21
Mode of application (M)														
Direct effect	1.51	1.55	0.324	0.375	0.405	0.419	34.5	34.6	38.6	39.0	43.2	43.3	7.5	8.0
Residual effect	1.41	1.46	0.299	0.355	0.380	0.398	32.4	32.9	37.7	38.3	39.2	39.8	7.4	7.8
Cumulative effect	1.57	1.61	0.346	0.397	0.427	0.438	35.5	35.6	39.5	39.7	44.5	44.6	7.6	8.1
SEm±	0.032	0.028	0.007	0.005	0.007	0.008	0.48	0.55	0.35	0.28	0.78	0.73	0.03	0.06
CD (P=0.05)	0.092	0.082	0.020	0.016	0.020	0.023	1.39	1.60	1.01	0.82	2.24	2.11	0.09	0.16
N x M														
SEm±	0.07	0.06	0.016	0.012	0.016	0.018	1.08	1.24	0.78	0.63	1.74	1.63	0.07	0.12
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Protein content and physical quality parameters

The data on protein content and physical parameters of wheat grain as influenced by the different combinations of nutrients and their modes of application are presented in Table 5. The effects of FYM, GM, and GM + B were statistically similar and significantly higher than the control on protein content of wheat grain in both the years of study. The highest protein content was recorded by GM + FYM + B, however, there was no significant difference between GM + FYM in either year of study. Previously, Kharub (2008) reported that protein content in wheat increased with increase in the dose of FYM, but the highest protein content (11-24%) was recorded under inorganic fertilizer. Hardness and sedimentation value of wheat grain were not significantly affected by FYM application in either year of study, whereas GM significantly increased the hardness in wheat grain over the control in both the years, and sedimentation value only in the second year of the study. The highest increase in hardness and sedimentation values were recorded with the combination of GM + FYM + B followed by GM + FYM. Inoculation of GM or GM + FYM with B did not show any significant advantage over GM alone or GM + FYM in either year of study.

Table 5. The effect of organic manures & biofertilizer combinations and modes of application on protein content and physical quality parameters of wheat grain.

Treatment	Protein content (%)		Hardness (HL)		Sedimentation value (ml)	
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
Organic manures & biofertilizers combination (N)						
Control	7.08	6.99	79.67	79.81	38.20	38.00
Farmyard manure (FYM)	8.17	8.47	82.77	83.10	41.01	41.39
Green manure (GM)	8.40	8.65	84.94	85.40	41.22	41.58
GM + biofertilizer	8.48	8.74	85.44	85.76	41.39	41.81
GM + FYM	8.93	9.15	88.95	89.24	43.33	43.92
GM + FYM + biofertilizer	9.01	9.26	89.68	90.30	43.36	43.92
Control vs others						
SEd±	0.47	0.42	1.96	1.77	1.63	1.75
CD (P=0.05)	0.96	0.86	4.00	3.62	3.33	3.57
Between others						
SEm±	0.24	0.21	0.98	0.89	0.82	0.87
CD (P=0.05)	0.68	0.61	2.83	2.56	2.36	2.52
Mode of application (M)						
Direct effect	8.67	8.90	86.93	87.32	42.32	42.53
Residual effect	8.10	8.39	82.78	83.18	40.71	41.03
Cumulative effect	9.02	9.26	89.36	89.78	43.15	44.01
SEm±	0.18	0.16	0.76	0.69	0.63	0.68
CD (P=0.05)	0.53	0.47	2.19	1.98	1.82	1.95
N x M						
SEm±	0.41	0.36	1.70	1.53	1.41	1.51
CD (P=0.05)	NS	NS	NS	NS	NS	NS

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Across the modes of application, the cumulative effect was significantly superior only over the residual effect in respect to protein content and sedimentation values, whereas there was a significant difference between the direct and cumulative effects in respect to the hardness value of wheat grain in both the years of study.

The interactions between nutrient combinations and their modes of application were not significant in either year of study.

Economics of wheat cultivation

The data on gross return, cost of cultivation, net return and the benefit-cost (B:C) ratio of wheat cultivation as influenced by the different combinations of nutrients and their modes of application are presented in Table 6.

Table 6. The effect of nutrient combinations and modes of application on the economics of the cultivation of wheat.

Treatment	Gross return ($x10^3$ Rs. ha^{-1})		Cost of cultivation ($x10^3$ Rs. ha^{-1})		Net return ($x10^3$ Rs. ha^{-1})		B:C ratio	
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
Organic manures & biofertilizers combination (N)								
Control	48.49	48.53	11.08	11.42	37.41	37.10	3.4	3.2
Farmyard manure (FYM)	65.15	68.08	16.76	17.44	48.39	50.63	2.9	2.9
Green manure (GM)	69.59	74.07	12.05	12.38	57.54	61.69	4.8	5.0
GM + biofertilizers (B)	74.13	79.11	12.16	12.49	61.96	66.62	5.1	5.3
GM + FYM	82.65	84.91	25.12	26.01	57.53	58.90	2.3	2.3
GM + FYM + B	86.90	89.20	25.23	26.12	61.67	63.08	2.4	2.4
Control vs others								
SEd±	2.68	3.08			2.68	3.08	0.31	0.25
CD (P=0.05)	5.48	6.29			5.48	6.29	0.63	0.52
Between others								
SEm±	1.34	1.54			1.34	1.54	0.15	0.13
CD (P=0.05)	3.87	4.45			3.87	4.45	0.44	0.37
Mode of application (M)								
Direct effect	77.16	80.33	21.86	22.62	55.30	57.7	2.5	2.6
Residual effect	63.90	66.44	11.08	11.42	52.82	55.0	4.8	4.8
Cumulative effect	85.99	90.45	21.86	22.62	64.13	67.8	2.9	3.0
SEm±	1.04	1.19			1.04	1.19	0.12	0.10
CD (P=0.05)	3.00	3.45			3.00	3.45	0.34	0.28
N x M								
SEm±	2.32	2.67			2.32	2.67	0.27	0.22
CD (P=0.05)	6.71	7.70			6.71	7.70	0.77	0.63

Note: Price of wheat grain (organic) was taken as Rs. 1650 q^{-1} and the price of wheat straw as Rs. 200 q^{-1} in both the years of study

There were significant effects: FYM over control; GM over FYM; GM + B over GM; GM + FYM over GM + B; and GM + FYM + B over GM + FYM; recorded in respect to the increase in gross return of wheat in both the years. However, the difference between GM + FYM and GM + FYM + B was not significant in the second year of the study. The cost of cultivation of a particular treatment did not vary in the three replications. The cost of rice cultivation varied from Rs 11080.5 ha^{-1} for control plots to Rs 25023.2 ha^{-1} for GM + FYM + B in first year, and from Rs 11424.4 ha^{-1} for control plots to Rs 26122.3 ha^{-1} for GM + FYM + B in the second year of study. The addition of FYM, GM, GM + B, GM + FYM and GM + FYM + B increased the cost of cultivation over the control by 51.3%, 8.8%, 9.8%, 126.7% and 127.7% respectively, in the first year and 52.7%, 8.3%, 9.3%, 127.7% and 128.7% respectively, in the second year of the study. The net return was significantly increased with the application of FYM over the control, GM over FYM, and GM + B over GM. The combination of GM + FYM was significantly superior to FYM, but not against GM alone. The highest net return was recorded with GM + B due to its low cost and comparable higher yields. The B:C ratio was decreased due to the application of FYM over the control whereas GM significantly increased the B:C ratio over the control and FYM in both the years of study. The highest B:C ratio was obtained with the application of GM + B as well as GM alone. Combinations of GM + FYM and GM + FYM + B significantly deceased the B:C ratio of wheat cultivation over all the rest of the nutrient combinations due to highest cost of cultivation incurred in these combinations.

Across the modes of application, the cumulative effect resulted in significantly higher gross and net return followed by direct and residual effects. However, there was no significant difference between direct and residual effects in respect to the net return in the second year of study. The B:C ratio was significantly higher in the residual effect compared to the cumulative and direct effects of nutrient combinations in both the years of the study.

Interactions between nutrient combinations and modes of application in respect to gross return (Fig. 2) showed that FYM and GM were similar in their direct and residual effects, but the cumulative effect of GM was significantly higher than the cumulative effect of FYM in both the years of study. The combination of GM + B was significantly superior over both FYM and GM in direct effect but no different in the residual and cumulative effects of nutrient combinations. Combinations of GM + FYM and GM + FYM + B were significantly superior to GM and FYM in all of the effects. Interactions in respect to the net return (Fig. 3) revealed that the net return was significantly higher with GM than FYM, and GM + B was superior over GM alone, in the direct and cumulative effects in both the years. However, in the second year of study GM + B was not different to GM alone. The combination of GM + FYM and GM + FYM + B were not significantly different to GM and FYM alone in their direct and cumulative effects, but the residual effects of these combinations were significantly superior over GM alone and FYM alone in both the years of the study. Interactions in respect to B:C ratio (Fig. 4) indicated that GM resulted in significantly higher B:C ratio than FYM in its cumulative and direct effects. There was no significant advantage of GM + B recorded over GM alone in respect to the B:C ratio. Combinations of GM + FYM and GM + FYM + B were not different to each other, and were both significantly superior over GM and FYM only in their residual effects.

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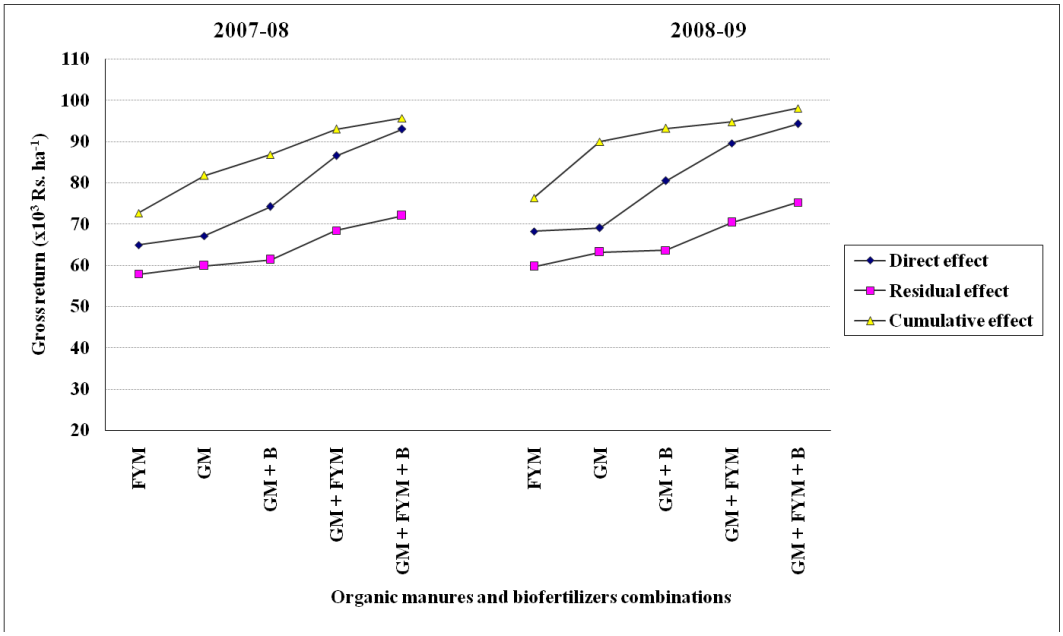

Fig. 2. The interaction effects of organic manures and biofertilizer combinations and modes of application on gross return (x103 Rs. ha^{-1}) of wheat.

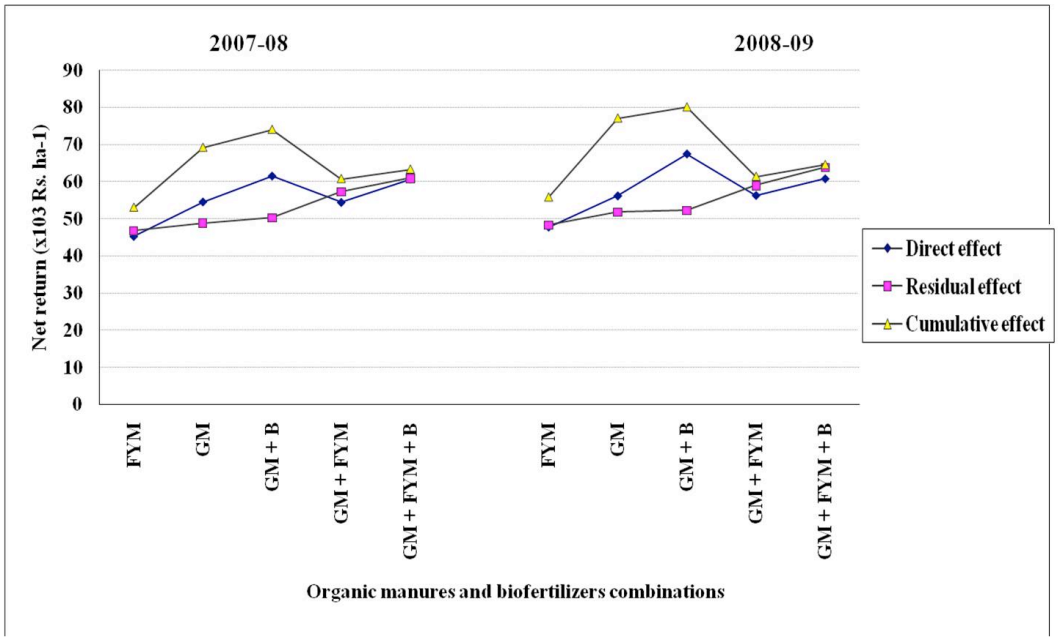

Fig. 3. The interaction effects of organic manures and biofertilizer combinations and modes of application on net return (x103 Rs. ha^{-1}) of wheat.

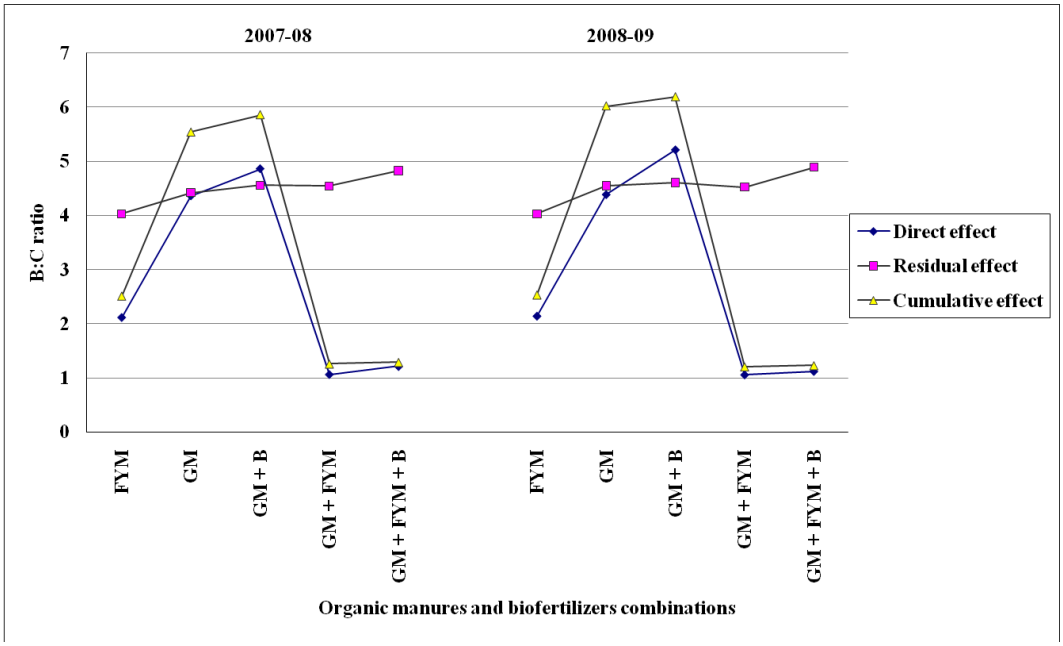

Fig. 4. The interaction effects of organic manures and biofertilizer combinations and modes of application on B:C ratio of wheat

Conclusion

The application of a combination of green manuring + farm yard manure + biofertilizers in a cumulative manner was found to achieve the highest yields of wheat. However, with lower input costs, an appreciable yield of wheat with enhanced net returns can be obtained by the application of green manuring and biofertilizers in a cumulative manner in organic farming of rice-wheat cropping system. This latter result applies under the costs established for the present study and assumes a buy-in by the farm of the inputs. However, where a farm is self producing of farm yard manure, or the costs of farm yard manure are lower than reported in this study, then in that case the application of farm yard manure can be expected to both enhance grain yields and net returns. Higher organic nutrient inputs result in higher yields. The challenge for the farmer is always to make the trade-off between the changing cost of inputs versus the changing market price for the produce and the changing premium for organic produce.

References

Apte, R. and Shende, S.T. 1981. Studies on Azotobacter chroococcum: II. Effect of Azotobacter chroococcum on germination of seeds of agricultural crops. Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene. Zweite Naturwissenschaftliche Abteilung: Mikrobiologie der Landwirtschaft, der Technologie und des Umweltschutzes (Central Journal of Bacteriology, customer parasites, infectious diseases and hygiene. Second Natural Sciences Department: Microbiology of agriculture, technology and environmental protection) 136 (7): 555-559.

Bhardwaj, V. and Tyagi, V.V. 1994. Impact of continuous manuring on crop yields and uptake of nitrogen, phosphorus and potassium. Journal of Potassium Research, 10 (3): 290-293.

Biswas, P.P. and Sharma, P.D. 2008. A new approach for estimating fertilizer response ratio - the Indian scenario. Indian Journal of Fertilizers. 4 (7): 59-62.

Cochran, W.G. and Cox, G.M. 1957. Experimental Design (II ed.) John Wiley and Sons Inc., New York, 611 p.

Davari, M.R., Sharma, S.N. and Mirzakhani, M. 2012. The effect of combinations of organic materials and biofertilisers on productivity, grain quality, nutrient uptake and economics in organic farming of wheat. Journal of Organic Systems, 7(2):26-35.

Duxbury, J.M.; Abrol, I.P.; Gupta, R.K. and Bronson, K. 2000. Analysis of long-term soil fertility experiments with rice-wheat rotation in South Asia. In: Abrol IP, Bronson K, Duxbury J.M. and Gupta R.K. (ed) Long-Term Soil Fertility Experiments in Rice-Wheat Cropping System. Rice-Wheat Consortium Res. Ser. No. 6, Rice-Wheat Consortium for the Indo-Gangetic Plains, New Delhi, India, pp. vii-xxii

Dwivedi, D.K. and Thakur, S.S. 2000. Effect of organics and inorganic fertility levels on productivity of rice (Oryza sativa). Indian Journal of Agronomy 45 (3): 568-574.

Fisher, R.A. and Yates, F. 1963. Statistical tables for biological, agricultural and medical research. 6th Edn. Oliver and Boyd, London.

Ghosh, T.K. and Saha, K.C. 1997. Effect of inoculation of BGA with Mg fixing agrobacteria on the nitrogenase activity in soils. Plant Biology 1: 244-252.

Kaushik, R.; Saxena, A.K. and Tilak, K.V.B.R. 2001. Selection and evaluation of Azospirillum brasilence strains at a sub-optimum temperature in rhizocoenosis with wheat. Folia Microbiologica 46(4): 327-332.

Khalid, K.W.; El-Sesawy, M.M.; El-Ghany, B.F.A. and Awadalla, S.Y.T. 1997. Interaction between organic manure mixtures, applied N-level and biofertilizers on calcareous soil properties and wheat production in Wadi Sudr, South Sinari. Egyptian Journal of Soil Science 37(3): 367-397.

Kharub, A.S. and Chander, Subhash 2008. Effect of organic farming on yield, quality and soil fertility status under basmati rice (Oryza sativa)-wheat (Triticum aestivum) cropping system. Indian Journal of Agronomy 53(3): 172-177.

Khosravi, H., Rastin, N.S. and Mohammadi, M. 1998. Effect of Azotobacter inoculation as a biological fertilizer on growth and yield of wheat. Soil and Water Journal, 12: 6(1-8): 111.

Ladha, J.K.; Fisher, K.S.; Hossain, M.; Hobbs, P.R. and Hardy, B. 2000. Improving the productivity and sustainability of rice-wheat systems of the Indo-Gangetic Plains: A synthesis of NARS – IRRI partnership research. Discussion paper no. 40. IRRI, Los Banos, Philippines, pp 1-31

Mishra, B. 2009. Advances in rice and wheat research for food and nutritional security. Paper presented at 9th Agricultural Science Congress on “Technological and Institutional Innovations for Enhancing Agricultural Income” held at Srinagar, India during June 22–24, 2009.

Nambiar, K.K.M. 1994. Soil fertility and crop productivity under long-term fertilizer use in India. Indian Council for Agricultural Research, New Delhi, India.

Patil, V.C. 2008. Declining factor productivity and improving nutrient use efficiency. Paper presented in National Symposium on “New Paradigms in Agronomic Research” held at Navsari, Gujarat, India during Nov., 19-21, 2008.

Paull, J. 2011. The uptake of organic agriculture: A decade of worldwide development. Journal of Social and Development Sciences, 2(3), 111-120.

Prakash, Anand; Singh, V.P.; Kumar, Rajeev and Singh, I.P. 2008. Effect of organics and micronutrient fertilization in rice (Oryza sativa)-wheat (Triticum aestivum) cropping system. Paper presented in National Symposium on “New Paradigms in Agronomic Research” held at Navsari, Gujarat during Nov., 19-21, 2008.

Prasad, R.; Shivay, Y.S.; Kumar, D. and Sharma, S.N. 2006. Learning by doing exercises in soil fertility (A Practical Manual for Soil Fertility), Division of Agronomy, IARI, New Delhi. 68 p.

Prasad, R. 2005. Rice-wheat cropping systems. Advances in Agronomy, 86: 255-339.

Rabie, K.A.E.; Nasr, S.A. and Amara, M.A. 1995. The effect of symbiotic nitrogen fixers on the growth and endogenous growth substances of wheat plants. Annals of Agricultural Science (Cairo), 40 (1): 11-32.

Ram, Moola; Davari, Mohammadreza and Sharma, S. N. 2011a. Organic farming of rice (Oryza sativa L.) - wheat (Triticum aestivum L.) cropping system: a review. International Journal of Agronomy and Plant Production. 2(3):114-134.

Ram, Moola; Davari, M. R. and Sharma, S. N. 2011b. Effect of organic manures and biofertilisers on basmati rice (Oryza sativa L) under organic farming of rice-wheat cropping system. International Journal of Agriculture and Crop Sciences, 3(3):76-84.

Rathore, A.L.; Chipde, S.J. and Pal, A.R. 1995. Direct and residual effects of bio-organic and inorganic fertilizers in rice (Oryza sativa)-wheat (Triticum aestivum) cropping system. Indian Journal of Agronomy, 40 (1): 14-19.

Shah, R.R.; Rai, R.K. and Mukherjee, P.K. 2000. Effect of green manuring of dhaincha and phosphorus on growth, yield and phosphorus uptake by wheat. Indian Journal of Agronomy, 45(4): 707-710.

Sharma, S.N.; Prasad, R. and Singh, S. 1995. The role of mungbean residue incorporation on productivity and nitrogen uptake of a rice-wheat cropping system. Bioresource Technology. 67: 171-175.

Singh, Ravindra and Agarwal, S.K. 2004. Effect of organic manuring and nitrogen fertilization on productivity, nutrient use efficiency and economics of wheat (Triticum aestivum). Indian Journal of Agronomy, 49 (1): 49-52.

Singh, S.; Prasad, R. and Sharma, S.N. 1995. Effect of blue green algae, nitrogen levels and modified urea materials on yield attributes and yield of wet land rice (Oryza sativa). Indian Journal of Agronomy, 40 (4): 594-597.

Stockdale, E.A.; Lampkin, N.H.; Hovi, M.; Keatinge, R.; Lennartssen, E.K.M.; Mac Donald, D.W.; Padel, S.; Tattersall, F.H.; Woffe, M.S. and Watson, C.A. 2001. Agronomic and environmental implications of organic farming systems. Advances in Agronomy, 70: 261-327.

Swift, M.J. and Woomer, P.L. 1993. Organic matter and sustainability of agricultural system: Definition and measurement. In: Mulongoy K and Merec R (ed) Soil Organic Matter Dynamics and Sustainability of Tropical Agriculture, pp. 3-18.

Thakur, D.S. and Patel, S.R. 1998. Growth and sink potential of rice as influenced by the split application of potassium with FYM in inceptisols of eastern-central India. Journal of Potassium Research 14 (1/4): 73-77.

Yadav, D.S. 2008. Long-term effect of nutrient management on soil health and productivity of rice (Oryza sativa)-wheat (Triticum aestivum) system. Paper presented in National Symposium on “New Paradigms in Agronomic Research” held at Navsari, Gujarat during Nov., 19-21, 2008.

Yadav, R.L. 1998. Factor productivity trends in a rice-wheat cropping system under long-term use of chemical fertilizers. Experimental Agriculture 34: 1-8.

Yadav, R.L.; Dwivedi, B.S. and Pandey, P.S. 2000. Rice-wheat cropping system: assessment of sustainability under green manuring and chemical fertilizer inputs. Field Crops Research, 65: 15-30.

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Lord Northbourne, the man who invented organic farming, a biography

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> *"He was a man of great vision, decisiveness, quiet humour and kindly authority ... who brought to every facet of his widely ranging life a rare sense of harmony and balanced purpose. Above all he was a widely read man of very considerable scholarship with deep philosophical understanding ... He was a man of great faith and rare belief who saw 'through a glass darkly' so much more than is given to most of us to see and experience"* Duncan Skilbeck *(1983, pp.78-79)*.

Abstract

It was Lord Northbourne (Walter James; 1896-1982) who gifted to the world the term 'organic farming'. His 1940 book *Look to the Land* is a manifesto of organic agriculture. In it he mooted a contest of "organic versus chemical farming" which he foresaw as a clash of world views that may last for generations. Northbourne's ideas were foundational in launching the worldwide organics movement, and the book was a turning point in his own life. This biography relies on primary sources to draw a picture of Lord Northbourne. He was a very shy man, a talented artist, a capable linguist, a keen sportsman and an Olympic silver medallist, a graduate and lecturer in agriculture of the University of Oxford, a lifelong farmer, he was profoundly spiritual, an accomplished author, and as a wordsmith he could be a compelling advocate for his cause as *Look to the Land* shows. His interest in biodynamics led him to visit Switzerland in 1939 to invite the leading advocate of the times, Dr Ehrenfried Pfeiffer, to present the first conference on biodynamic farming in Britain, and it was in the following year that *Look to the Land* appeared. Rather than the mechanics or the practices of organics, Northbourne's book presents the philosophy, the rationale, and the imperative of organic farming. The ideas of his organics manifesto took on a life of their own and were quickly spread globally, with early uptakes in the USA and Australia. Meanwhile, while maintaining lifelong interests and commitments to agriculture and education, Northbourne became progressively more engaged with spiritual matters, and his subsequent writings reflect his growing interest in metaphysics. He translated books by leading perennialist authors Frithjof Schuon, René Guénon, and Titus Burckhardt. Northbourne led a full life, but it is *Look to the Land* that is his enduring ideological legacy. This biography examines: firstly, the book, its ideas, history, uptake and impact; secondly, Northbourne's life before *Look to the Land*; and thirdly, his life after *Look to the Land*.

Key words: Walter Ernest Christopher James, 4th Baron Northbourne, organic agriculture, biodynamic farming, biodynamic agriculture, organic food, Oxford University, Perennialism, perennialist philosophy, Traditionalist School, Traditionalism, Anthroposophy, Ehrenfried Pfeiffer, Eve Balfour, Rudolf Steiner, René Guénon, Frithjof Schuon, Kent.

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Introduction

Farmer, philosopher, writer, Oxford University lecturer in agriculture, and Olympic silver medallist, Lord Northbourne (1896-1982) (Images 1 & 2) wrote of the clash of agricultures, "organic versus chemical farming" in his first book, *Look to the Land* (1940a). The book is a manifesto of organic agriculture, the canonical work in the field, and its legacy secures Northbourne's place in history. Northbourne tapped a vein of disquiet over twentieth century changes to agriculture, he introduced the term 'organic farming', and his ideas and terminology were promptly taken up internationally. Northbourne secularized ideas that Rudolf Steiner (1924) and biodynamic farmers (Pfeiffer, 1938) had set in train beginning at Koberwitz (now Kobierzyce, Poland) in 1924 (Paull, 2011a). The publication of *Look to the Land* was a turning point in Northbourne's life, and this paper presents an account of his life in three sections: the book itself; his life before; and his life after.

Methodology

This biography of Lord Northbourne draws predominantly on primary source material, both published and unpublished items including personal letters and other manuscript items. Archives, libraries and sources consulted included: the Oxford University Archives, Oxford; the Bodleian Library, Oxford; Magdalen College Archives, Oxford; Wye College Archives, Wye; King's College, London; Eton College Archives, Windsor; the Hampshire Record Office, Winchester; the British Library, London; the Goetheanum Archives, Dornach; the Biodynamic Association, Stroud; the Soil Association, Bristol; and the present Lord Northbourne (Walter James' son Christopher James).

Results

1. *Look to the Land*: Organic versus Chemical Farming

1.1 Introduction

The wartime chemistry of WWI (1914-1918) opened a Pandora's box of cheap nitrogenous compounds and poisonous gases (Charles, 2005). However, young men dying an ugly death from toxic gas seemed the antithesis of a heroic death and the perpetrators of this novel lethality seemed ungentlemanly. For the purposes of modern warfare, the box was more or less snapped shut by the *Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare* (von Eckardt & 42 others, 1925) - but not for agriculture. In the inter-war years, repurposing the chemistry of poisons and the output of the Haber-Bosch ammonia process of 'fixing' nitrogen, for application to the food chain, seemed, to many, and in particular to policy makers, to be 'scientific' and to epitomize 'progress' (Smil, 2001).

In the early months of WWII, Lord Northbourne expressed the disquiet of a generation about the shift to the 'chemicalization' of the food chain. His 206 page book *Look to the Land* was first published in Britain on 30 May 1940 (Northbourne, 1940d, p.9). To a Britain once more at war, Northbourne's book proffered a gentle message: "It now remains for us to try the way of love" (p.192). Northbourne's message seems incongruous for the mood of the times, where contemporaneous newspaper reports wondered "What chance remains of saving France?" (Hammerton, 1940, p.1) and

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presented tallies of “k. i.” (killed and injured) on the back pages, and centerfolds comprising photos such as Australian volunteers “From ‘Down Under’ to the Defence of the Homeland” (p.12). WWII Britain would appear to be an inauspicious time and place for Northbourne’s message of love to find a receptive audience, and yet, against the odds, it did.

Despite the increasingly imperilled state of Britain, books continued to be published and reviewed. A leading British agrarian periodical, *The Field*, wrote of *Look to the Land* that:

> This book sounds an alarm. Lord Northbourne knows that for life and well-being man is dependent upon the soil. In this book he warns us that we are making improper use of our heritage … He believes that salvation will come not through government, not through large-scale centralised control, but by individual labours of love … That it is a good solution, the proper solution, we have no doubt … this is one of the best, one of the most vital, farming books published in the last 20 years (The Field, 1940, p.1004).

Northbourne coined the term ‘organic farming’ (James & Fitzgerald, 2008; Paull, 2006; Scofield, 1986). Scofield referred to *Look to the Land* as a “forgotten classic” (1986, p1). A recent history of organics, *Organic Farming, An International History* (Lockeretz, 2007) continued the ‘forgetfulness’ and ignored Northbourne entirely. Some US authors, for example Michael Pollan (2006) and Lee Silver (2006), mistakenly attribute or imply coinage of the term to the American publisher, Jerome Rodale (1898-1971), citing his use of the term from 1942 which is two years after *Look to the Land* (1940). Rodale was an entrepreneur, a vigorous promoter, popularizer, and repackager of ideas, who actively harvested ideas out of Britain, and, in modern marketing terminology, a ‘fast follower’ (Jackson, 1974). He was the first to publish a specifically ‘organic’ periodical; his *Organic Farming and Gardening* appeared in May 1942, and he sought agricultural advice from biodynamics pioneer and organics advocate Ehrenfried Pfeiffer (1899-1961), the author of *Bio-Dynamic Farming and Gardening* (1938), who had, by that time, moved from Switzerland to the USA (Koepf, 1991).

The first occurrence of ‘organic farming’ as a distinct phrase appears where Northbourne warns:

> In the long run, the results of attempting to substitute *chemical farming* for *organic farming* are probably far more deleterious than has yet become clear. It is perhaps worth pointing out that the artificial manure industry is very large and well organized. Its propaganda is subtle, and artificials will die hard. But we may have to relearn how to treat the land before we can manage entirely without them, or without poisonous sprays … imported chemicals can by no means make up for a loss of biological self-sufficiency [italics added] (p.103).

Northbourne sets up a clash of agricultures, pitting them in contention, within his Chapter 3 heading, as: “Organic versus chemical farming” (p.81). This contestation recurs in page headings as “organic v. chemical farming” at pages 99 and 101. *Look to the Land* is a manifesto of organic farming and it lays the ideological and philosophical foundation for differentiating organic farming from chemical farming.

1.2 Why Organic?

A key contribution of Northbourne was to take Rudolf Steiner's idea of 'the farm as organism' and derive from it a named practice, a differentiated agriculture, 'organic farming' (Paull, 2006; Steiner, 1924). In *Look to the Land,* Northbourne wrote of "the farm as a living whole" (p.81). He declared that: "the farm itself must have a biological completeness; it must be a living entity, it must be a unit which has within itself a balanced organic life" (p.96). A farm that relied on "imported fertility … cannot be self-sufficient nor an organic whole" (p.97). He declared that: "The farm must be organic in more senses than one" (p.98). He maintained the holistic view that: "The soil and the micro-organisms in it together with the plants growing on it form an organic whole" (p.99).

Northbourne's underlying concept of 'the farm as organism' can be traced back to Ehrenfried Pfeiffer's book *Bio-Dynamic Farming and Gardening* (1938), and Pfeiffer had it from Rudolf Steiner's 1924 *Agriculture Course*. Steiner (1861-1925) declared, in the series of eight lectures held at Koberwitz, that: "Truly, the farm is an organism" (1924, lect.VIII, p.7). Steiner's disciple, Ehrenfried Pfeiffer wrote that: "the cultivated field is a living organism, a living entity in the totality of its processes" (1938, p.35), and that the farmer needs to "maintain at a high level his living organism, the farm" (p.40).

At the time he published his *Bio-Dynamic Farming and Gardening*, Pfeiffer was the Director of the Bio-chemical Research Laboratory at the Goetheanum, the headquarters of the Anthroposophy movement, in Dornach, Switzerland. Pfeiffer played a key role in testing and evolving Steiner's ideas into biodynamic agriculture, a system which eschewed synthetic fertilisers and pesticides (Paull, 2011c). In January 1939, Northbourne visited Pfeiffer in Switzerland to organise the first biodynamics conference in England, and at which Pfeiffer was the lead lecturer (Northbourne, 1939b). The outcome was the *Betteshanger Summer School and Conference on Bio-Dynamic Farming* conducted over nine days, 1-9 July 1939, at Northbourne's estate. One of Pfeiffer's lectures at the conference was "The Farm as a Biological Organism" (Northbourne, 1939a; Paull, 2011b).

1.3 Publication history of Look to the Land

Look to the Land was published by J.M. Dent, London, in 1940. The book was immediately taken up as a club edition by Basis Books (1940b). This was a subscriber club, where members received a book per month; *Look to the Land* was the eleventh book published for Basis Books, London. The advantage for subscribers was that they obtained their books "by virtue of their contract, at low prices" (1940b, verso). The advantage for the original publisher was that a guaranteed uptake of the production run offset some of the setup costs and thus reduced the unit production cost. For the author it offered an audience more diversified than those who might frequent a bookshop and seek out, in this case, an agrarian book. Dent printed their second impression, in 1942, to the prevailing 'War Economy Standard', employing paper of a thinner and poorer quality, reducing the point size of the text, and thereby trimming the page count, from 206 to 186, while maintaining the integrity and completeness of the text. The 1946 post-war third impression followed the 1942 text and pagination.

The currently available 2003 Sopia Perennis imprint of *Look to the Land* (1940c) has the advantage that it is a print-on-demand title and hence readily available. This latest edition has eliminated the 'Index' and the 'Bibliography' of earlier versions, and it is a "revised"

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edition with some unfortunate textual redactions. Alternatively, a scan of the original book is available for free download at www.soilandhealth.org.

1.4 The Uptake of Look to the Land

Northbourne's book *Look to the Land* was one of "the publications issued and distributed by the Economic Reform Club and Institute" (Rowe, 1944, p.16). Northbourne was a past president of the Club. Rowe reported that in the field of "agriculture and food production … His book, 'Look to the Land' is a notable contribution and has been widely studied" (p. 20). Within months of its release in Britain, *Look to the Land* was available in Australia (Advertiser, 1940a) and favourably reviewed in the Australian press (e.g. Advertiser, 1940b; SMH, 1940).

Image 1.Walter James, lecturer in agriculture at the University of Oxford (Source: ISIS, 1921, p.556).

Image 2. Lord Northbourne, c.1940, self portrait (detail),(author's photograph; original oil painting in private collection).

Writing in *England and the Farmer*, published in 1941, Massingham recommends reading his own new book in conjunction with *Look to the Land*:

> If this book be read in conjunction with Lord Northbourne's noble and wide-embracing 'Look to the Land' published last year, the reader will come away flushed with a new light, contrary, it is probable, to all he has been brought up to think and believe, but valid, and a way out of the decadence from which Whitehall has not been able to save our English country. To refuse this way out is no less than to surrender, whether in war or peace, to the forces of death (p. 2).

Eve Balfour (1899-1990) published *The Living Soil* in 1943, and that book led directly to the founding in 1946 of the Soil Association which has become the UK's leading organics advocacy group (Brander, 2003). Balfour declared in the Introduction to her book that: "The reader will find that much of this book consists of quotations" (1943, p.10). Chapter 1 of Balfour's book presents just one page of her own text before she inserts an

uninterrupted multi-page excerpt of Northbourne's *Look to the Land*, of his pages 14 through 21, intact and unchanged, and hence a substantial part of Balfour's first chapter is Northbourne's work repackaged. Despite her debt to Northbourne, Balfour's book did not adopt Northbourne's terminology of 'organic farming' and 'chemical farming', and her book is the poorer for that.

In England, as early as 1944 Massingham, in his book *The Natural Order,* described *Look to the Land* as "a biological classic" (dated 1944, p.17). Massingham informed his readers that in *Look to the Land*, "The salient questions in agriculture and civilisation are here lucidly expounded in a short book" (1945, p.172).

Writing from India, Wrench (1946) dedicated his book *Reconstruction by Way of the Soils*: "To Lord Northbourne" (p.2), and he stated in his Acknowledgements that: "Lord Northbourne's book was published in 1940, and it has been my frequent companion in the three years which I have taken in the writing of this book" (p.5).

Writing in Australia, in his *Soil, Food and Life*, Professor Stanton Hicks (1945) recommended *Look to the Land* and acknowledged Northbourne's work as a source of inspiration. Australian author Elyne Mitchell in her *Soil and Civilization* (1946), likewise acknowledged Northbourne and *Look to the Land*.

In the US, a multipage excerpt from *Look to the Land* appeared in *Bio-Dynamics*, the journal of the Bio-Dynamic Farming and Gardening Association, as "Let Us Get Back to Earth" (Northbourne, 1948). A footnote to the article described Northbourne as "a Bio-Dynamic farmer of Kent, England" (p.32). Ehrenfried Pfeiffer (1952) adopted Northbourne's bifurcation of agriculture into chemical versus organic. Pfeiffer was consistently a champion for biodynamic agriculture, nevertheless he followed Northbourne in adopting his framing of organics as the lead category, within which biodynamics sat as a specific implementation. Pfeiffer wrote: "Our definition of 'organic' is not the one of the chemist, but pertains to the modus of production by nature, not artificially or synthetically" (1983, p.17).

As Heckman observes: "In 1940, Northbourne published an influential book, *Look to the Land*, in which he elaborated on the idea of the farm as an 'organic whole'" (2006, p.146). *Look to the Land* was promptly taken up by like-minded agrarian authors, and it quickly appeared in the bibliographies of many such writers. Those bibliographies included those of: Viscount Lymington's *Alternative to Death* (1943); Rolf Gardiner's *England Herself* (1943); the reissue in 1947 of Ehrenfried Pfeiffer's *Soil Fertility, Renewal & Preservation* (1938); and John Blackburn's *Organic Husbandry, A Symposium* (1949). (Albert Howard's books were issued without bibliographies).

Northbourne, in *Look to the Land*, recommended the works of a prominent Quaker socialist, Samuel George Hobson (1870-1940). Hobson's works *Functional Socialism* (1936) and *Pilgrim to the Left - Memoirs of a Modern Revolutionist* (1938) appear in Northbourne's "Select Bibliography". Hobson, in his autobiography, *Pilgrim to the Left*, described Northbourne as a "friend" (p.42), while Northbourne described Hobson as a "courageous and original" thinker (1940a, p.145) and he devoted pages 145-147 of *Look to the Land* to praising Hobson's socialist ideals and ideas.

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1.5 Views in Look to the Land

Northbourne's book criticized the prevailing direction of agriculture and he warned that:

> Farming cannot be treated as a mixture of chemistry and cost accountancy, nor can it be pulled into conformity with the exigencies of modern business, in which speed, cheapness, and standardizing count most. Nature will not be driven. If you try, she hits back slowly, but very hard (pp.90-91).

He identified biodynamics as one proven method of practising organic farming:

> … the 'bio-dynamic method', evolved in accordance with the recommendations of the late Dr Rudolf Steiner. The ... method has been highly developed in the course of some fifteen years' work on the Continent, and its effectiveness may be said to be proved, though its supporters would be the last to claim that there is no more to be learnt about it (p.173).

He was a strong and early critic of, what has more recently come to be called, 'food-miles':

> It is ludicrous to cart stuff about all over the world, so someone can make a 'profit' out of doing so, when that stuff could much better be produced where it is wanted (p.104).

Part of Northbourne's message was that: "Health depends on nutrition" (p.52). He wrote of obesogenic eating long before its current entry into the public health debate:

> One strange consequence of the prevailing loss of real quality in food is that a great many people, even relatively poor people, eat habitually far too much ... Malnutrition is rarely nowadays a quantitative phenomenon. The organism can never be satisfied with the fearsome, tainted, bleached, washed-out, and long-dead material with which it is supplied, and being unsatisfied calls out for more. In vain does man distend his stomach with an excess of such things - what he must have is not there (p.71).

Northbourne presented an early formulation of what is now termed the Precautionary Principle:

> … if we waited for scientific proof of every impression before deciding to take any consequential action we might avoid a few mistakes, but we should also hardly ever decide to act at all. In practice, decisions about most things that really matter have to be taken on impressions, or on intuition, otherwise they would be far too late … We have to live our lives in practice, and can very rarely wait for scientific verification of our hypotheses. If we did we should all soon be dead, for complete scientific verification is hardly ever possible. It is a regrettable fact that a demand for scientific proof is a weapon often used to delay the development of an idea (p.41).

Northbourne wrote against the view of the 'conquest of nature':

> The idea of conquering nature is as sensible as if a man should try to cut off his own head so as to isolate his superior faculties … We have invented or

> imagined a fight between ourselves and nature; so, of course the whole of nature, which includes ourselves as well as the soil, suffers … We have tried to conquer nature by force and by intellect. It now remains for us to try the way of love (pp.191-192).

Northbourne warned in *Look to the Land* that reversing the current tide would be the work of generations:

> It is a task for generations of concentrated effort, slow and laborious, needing all available skill and resources … A combination of cooperation and individual effort … And those engaged will be fighting a rearguard action for many decades, perhaps for centuries (p.115).

2. Life before *Look to the Land*

Lord Northbourne had a privileged life. He was born Walter Earnest Christopher James, in London on 18 January 1896, as he stated on his Oxford University enrolment paperwork (James, 1919). He attended Sandroyd School and then five years at Eton College (ISIS, 1921). At Eton he won the "Lower Boy French Prize" in 1909, he was a "House Captain", he rowed in the House IV, and, in 1914, he rowed in the VIII and he was Eton's "Captain of the Boats" (Hatfield, 2008).

Walter James (he was 'Lord Northbourne' from December 1932) served in WWI (1914-1918) in the 2/4th Northumberland Fusiliers, from 15 December 1914, serving in Salonika (1917) and Palestine (1917-1919) with the rank of Lieutenant (Craig & Gibson, 1920).

2.1 Oxford University

On his return from the war, he matriculated at Oxford University, on 1 May 1919, listing, on his candidature form, his father's occupation as "Artist", declaring a London address, and Magdalen College as his Oxford University college (James, 1919). Magdalen College (pronounced locally as 'maudlin') was founded in 1458, is situated on the River Cherwell and is opposite the University of Oxford Botanic Garden (Tyack, 1998). Northbourne was a student at the School of Agriculture and Forestry of Oxford University and a resident at Magdalen College (1919-1921). He achieved a distinction in Agriculture in Trinity Term 1920 and he received his degree of BA Agriculture (Distinction) on 20 January 1921 (Petre, 2008).

Oxford University student magazine, *The Isis*, profiled James as a celebrity, presenting him as an "ISIS Idol" and declaring that: "he graduated with such success in the School of Agriculture that for these last two Terms he has been initiating awe-struck pupils into the mysteries of patent manures. He is, then, an accomplished agriculturalist" (ISIS, 1921, p. 3).

The reverse of James's Oxford student record card reads: "Farming about 1000 acres" (University of Oxford, c.1920). In the Magdalen College Register of 1922 his occupation is listed as "Lecturer, School of Rural Economy" and "farming", with his address as "Nettlebed, Oxfordshire" (Magdalen College, 1922, p.119). He was a lecturer in the School of Rural Economy, University of Oxford, from 1921 to 1923 (ISIS, 1921; Magdalen College, 1979).

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James studied a shortened course at Oxford. This was a consequence of a University decree, approved by Convocation on 12 June 1917, whereby military service undertaken before matriculation was reckoned as equivalent to a number of terms of residence. Nine terms were usually required for an Oxford undergraduate degree, but for WWI returnees this was relaxed, and James studied for four terms (Petre, 2008).

James was a champion rower. He was a member of the Oxford University Boat Club (OUBC) VIII, 1920-1921 (Magdalen College, 1979). He was elected President of the OUBC in 1920 (ISIS, 1920). The Oxford student magazine *The Isis* stated that: "he is the backbone of the Varsity Eight, and would be of any Eight" (ISIS, 1921, p.3). The historian of the Magdalen College Boat Club, Roger Hutchins, described James' period, 1920-21, as "the Second Golden Era" for rowing at Magdalen (Hutchins, 1993, p.37).

Five members from Magdalen, including "Jimmy James (later Lord Northbourne)", and three rowers from Cambridge, competed in the 'Rowing Eights' event in the 1920 Olympics in Antwerp, Belgium. Hutchins reports that: "They even had to carry their boat two miles from Brussels station to the course a few days before the race" (Hutchins, 1993, p.37). The British Rowing Eight team returned with Olympic Silver medals (databaseOlympics.com, 2006).

2.2 Lord Northbourne

On the death of his father on 24 December 1932, James succeeded to the title as 4th Baron Northbourne (Burke, 1938; Magdalen College, 1934). His books and articles are henceforth authored as 'Lord Northbourne', and his letters are generally signed simply as 'Northbourne'. He was now entitled to a seat in the House of Lords.

It has been asserted that Northbourne did not take up his seat in the House of Lords (James, 2008), but that account is mistaken. The Journal of the House of Lords recorded that on Wednesday 20 June 1934: "L. Northbourne takes his seat. Walter Ernest Christopher Lord Northbourne sat first in Parliament after the death of his father, Walter John Lord Northbourne, his Lordship having first, at the Table, taken and subscribed the Oath, pursuant to the Statute" (House of Lords, 1934, Q3). Hansard records that Lord Northbourne first addressed the House of Lords on 11 July 1934 (Northbourne, 1934). He took the oath subsequently on two occasions (House of Lords, 1936, 1937) but made no further contribution.

Northbourne was the first President of the Economic Reform Club, London, 1936-1937. At the inaugural address on 15 May 1936 to the, then, Petition Club and seeking an enquiry into "the causes of Poverty and War", he signalled that the problems before them were systemic, and that "We have a long job before us". He told his audience of economic reformers that "the Club exists to help the monetary reform movement to present a united front", and he warned that: "The time to quarrel about the minutiae of our pet schemes is not yet" (in Rowe, 1944, p.8). In that first year the name evolved from the 'Petition Club' to the 'Economic Reform Club', before settling on the 'Economic Reform Club and Institute' (Rowe, 1944).

Northbourne was one of the authors included in *Three Addresses on Food Production in Relation to Economic Reform* published by the Economic Reform Club and Institute. The addresses were delivered on 19 March 1940, two months prior to the release of *Look to the Land*. Northbourne told his audience: "plants and animals, and the soil … We and

they can, in fact, be considered as one organism" (Northbourne, 1940d, p.7). The "Who's Who in the Economic Reform Club" stated that: "In addition to his activities on behalf of economic reform, Lord Northbourne's principal interest has been in agriculture and food production" (Rowe, 1944, p.20).

Northbourne inherited the family estate in Kent (following his father's death) and took up residence there. His address is then recorded as "Northbourne Court, Kent" (Magdalen College, 1934, p.186), and his occupation as "Farmer and landowner" (Magdalen College, 1939, p.176), and he spent the rest of his life residing there.

2.3 Wye College & Swanley Horticulture College

Northbourne had a long association with two agriculture colleges, Swanley Horticultural College and Wye College (aka South-Eastern Agricultural College). He was appointed a Governor of Wye College (established 1447) in 1925, and maintained this association for four decades. Northbourne was Chairman of the Governing Body of Swanley Horticultural College from 1938 until it amalgamated with Wye College in 1945. Swanley Horticultural College dates from 1889. It became a women's college in 1902 (Morrow, 1984).

Art was a "lifelong pastime" for Northbourne (James, 2008, p.xviii). Already at Oxford, his interest in art was acknowledged, and he was described as "a great artist as well" (ISIS, 1921, p.3). The Principal of Wye College, Duncan Skilbeck, described Northbourne as "a painter of consummate skill whose pictures are a joy to live with" (quoted in Richards, 1994, p.215). Skilbeck's reference was to the artworks by Northbourne in the Wye College art collection. On the present author's visits in mid 2008 there were eight Northbourne watercolours displayed on the walls of the Northbourne Room at the College, four landscapes and four floral works; the College has since closed.

Northbourne's son describes him as a biodynamic farmer (James, 2008). Rudolf Steiner had presented his *Agriculture Course* in 1924 at Koberwitz (Kobierzyce) and his teachings were developed into 'biodynamic agriculture' (Paull, 2011c). There were no British attendees at the Koberwitz course (Paull, 2011a), and Steiner did not present any agriculture lectures in Britain. Steiner did, however, present a two week conference at Manchester and Keble Colleges in Oxford in the summer of 1922, and this was concurrent with Northbourne's time at Oxford (Paull, 2011e). The topic of the conference, "Spiritual Values in Education Social Life" (Mackenzie, 1922), addressed two of Northbourne's own lifetime-enduring interests, education and spiritual values. The present author did not locate evidence that Northbourne and Steiner ever met, and the list of attendees of the Oxford Conference was not located, however, this was the one clear opportunity when the interests and geography of these two organics pioneers coincided, and such a meeting cannot be ruled out.

Two years after his Oxford conference, Steiner advised the attendees at his *Agriculture Course* at Koberwitz to test and develop his agriculture ideas to a stage suitable for publication. It was Ehrenfried Pfeiffer who brought this instruction to fruition with the publication of his book *Bio-Dynamic Farming and Gardening* (1938) which appeared in five languages (Paull, 2011c). In the same year, Northbourne published an article on world economy, alongside articles by biodynamic and anthroposophic authors Lili Kolisko, Eugene Kolisko, and Max Stibbe, in *The Present Age*, a journal edited by leading anthroposophist Walter Johannes Stein (Northbourne, 1938c).

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2.4 Betteshanger Biodynamic Conference

Northbourne met Pfeiffer several times in 1938, in Kent and at Viscount Lymington's Farleigh Wallop estate (Northbourne, 1938a; Portsmouth, 1965). In January the following year Northbourne travelled to Switzerland to meet with Pfeiffer to organize a Biodynamics conference in Britain (Northbourne, 1939b). The outcome was that Northbourne hosted the *Betteshanger Summer School and Conference on Bio-Dynamic Farming* (1-9 July 1939) at his estate in Kent.

Leading biodynamics practitioners and scholars of the day, Ehrenfried Pfeiffer, Otto Eckstein, and Hans Heinze, travelled from Switzerland and the Netherlands to Betteshanger, on Northbourne's estate in Kent, to present a nine day practical course for British farmers.

Although much of the work of Rudolf Steiner, Anthroposophy and associated initiatives, including biodynamic agriculture, had initially found fertile ground in Germany, the rise of Adolf Hitler and the Nazis had created a hostile environment there, culminating in persecutions, imprisonments, closures and bans. The German Anthroposophical Society was banned in the territory of the German Reich in 1935 as subversive to the ideals of National Socialism. Hitler had ranted against Steiner and Anthroposophy as early as 1921. Biodynamic products were banned in Germany in 1933. Waldorf schools were prohibited from accepting new students in 1936, and were finally closed in 1941 (Werner, 1999). The development and proliferation of biodynamics had been co-ordinated from Switzerland from the outset (Paull, 2011f) and thus it was that Northbourne had turned to Pfeiffer in Switzerland when he set out to organise and host a biodynamics conference.

An account of the Betteshanger Conference appeared in the *News Sheet of the Bio-Dynamic Method of Agriculture*. Of the course, Northbourne wrote: "It is extraordinary how many nice points invariably arise when a few are gathered together to perform any of the absorbing tasks associated with bio-dynamic farming and gardening" (Northbourne, 1939a, p.10). Viscount Lymington (writing later as the Earl of Portsmouth) described the Betteshanger Summer School: "It was one of the most exciting weeks I ever spent. We would work part of the day on his bio-dynamic methods, and then both for recreation and refreshment Pfeiffer would lecture to us in the evenings" (Portsmouth, 1965, p.84).

The Betteshanger Conference ended on 9 July, 1939, Britain declared war on 1 September, and the opportunity for further personal meetings with Pfeiffer was lost as travel opportunities were curtailed and Pfeiffer subsequently moved to the USA. When Northbourne's *Look to the Land* appeared, it was without any of the trappings of Anthroposophy or biodynamics, although the book did single out Steiner's biodynamic methods for praise, "its effectiveness may be said to be proved" (p.173), but without being prescriptive or exclusionary.

2.5 Misconceptions

It has been asserted that Northbourne was a "prominent disciple" of Albert Howard (Conford, 2001, p.72) but that claim is mistaken. These were two very different personalities travelling quite different life paths, and Northbourne was an independent thinker. In his book *Look to the Land*, Northbourne refers to "the 'Indore' process, developed from ancient Indian practices and introduced into this country by Sir Albert Howard" (Northbourne, 1940a, p.173). His book's bibliography cites Howard, including

the 1931 Howard & Wad book advocating composting, *The Waste Products of Agriculture*. Northbourne told a Kinship in Husbandry meeting held at Merton College, Oxford University, in 1942, of "The necessity of maintaining fertility by organic manuring alone" (Northbourne, 1942a, p.5). He nominated three methods for achieving this, including: "The second category I call the Indore-Hunza-Chinese method - Chinese for short"; and "the third is the Bio-dynamic method of Rudolf Steiner" (p.6). By characterising Howard's 'Indore' method as 'Chinese', Northbourne implicitly signals what Louise Howard (1954) later admitted, namely that the so-called Indore method of composting was derived from descriptions of long established Chinese practices. Such practices were described and illustrated in King's (1911) US-published book *Farmers of Forty Centuries, or Permanent Agriculture in China, Korea and Japan* which was first published in Britain in 1927 (Paull, 2011d). Northbourne stated that: "You will see that I am prejudiced in favour of the B-D [Bio-Dynamic] method, and if asked 'how best can our ideas be expressed in terms of farm management ideas' could only answer accordingly; though I don't pretend to understand it fully" (Northbourne, 1942a, p.6). Both Northbourne and Howard, along with Ehrenfried Pfeiffer and Viscount Lymington (Gerard Wallop), participated in the development of the Farleigh Experiment during 1938 (Northbourne, 1938b; Paull, 2011b). However, for Northbourne's Betteshanger Conference, presented in Kent in 1939, Howard was very intentionally excluded by Northbourne (Paull, 2011b).

A false claim has been made that "Lord Northbourne may have belonged for a time to the British Union of Fascists" (Conford, 2002, p.236). There is not a scintilla of evidence to substantiate such an assertion, and it is a claim that is incongruent with Northbourne's life and character, his life's work, and his writings. In lieu of evidence for his curious assertion, Conford uses a novel and dubious 'methodology'. He cites an obscure 1965 work of fiction which he states features a character named "Captain Bohun-Borsholder", of which name, Conford declares: "all the letters of 'Northbourne' can be found in the full name" (2002, p.241). As a novel research 'method' this is more worthy of a party-game rather than historiography, and it lacks any merit or credibility.

The term 'organic school' has been used by some writers (e.g. Conford, 2001) as a collective description for a diversity of individuals and/or groups with agrarian interests pre-WWII. The 'organic' in such a nomenclature needs to be read as a post hoc construction and attribution which adopts Northbourne's 'organic' coinage of 1940. Certainly, before that date, recipients of the descriptor did not use it to describe themselves, and would not have recognised it. Thus the use of 'organic school' to describe people, events and times pre-*Look to the Land* needs to be read as anachronistic and hence with caution.

3. Life after *Look to the Land*

Look to the Land was a turning point in Northbourne's life, and as the book took a trajectory that was perhaps predictable, his own life took a path that would not have been anticipated. His agricultural ideas promptly were taken up internationally, while he himself embraced new religio-philosophical pursuits.

In New York, the publishing entrepreneur Jerome Rodale founded the periodical *Organic Farming and Gardening* in 1942, the world's first specifically 'organic' periodical. In Sydney, the Australian Organic Farming and Gardening Society (AOFGS) was founded in 1944 to promote organic agriculture, the world's first specifically 'organic' association

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(Paull, 2008, 2013a). In Britain, Eve Balfour quoted liberally from *Look to the Land* in her own book, *The Living Soil* (1943), which book led to the founding of the Soil Association in 1946 (Douglas, 1946). Northbourne was invited to the founders' meeting, in London, of the "Proposed Soil Association", but he sent his apologies (Balfour, 1945) and he appears to have played no role in the development of that association.

3.1 Perennialism

Northbourne was "a shy man of culture and sensitivity" (Richards, 1994, p.215), and thoughtful and contemplative intellectual pursuits suited him more than an activist role. *Look to the Land*, with its advocacy of the holistic outlook, led to an approach from Marco Pallis who introduced Northbourne to the Perennialist School of philosophy, also known as the Traditionalist School (James, 2008). According to Aldous Huxley's *The Perennial Philosophy* (1946), the German philosopher and mathematician Gottfried Leibnitz (1646-1716) coined the phrase "Philosophia Perennis", while Schmitt (1966) dates the term back to Agostino Steuco's 1540 book, *De Perenni Philosophia*. The perennialists are in pursuit of transcendental truths, what might be called 'meta-ecumenical' wisdom. Northbourne's perennialist circle included: Marco Pallis, a convert to Tibetan Buddhism; Titus Burckhardt, a convert to Islam; René Guénon, a Sufi scholar living in Egypt: and Frithjof Schuon who wrote on Islam and Sufism.

As a schoolboy, Northbourne had already demonstrated his skills as a linguist, winning school awards in Latin and Greek at Sandroyd and in French at Eton (Hatfield, 2008; ISIS, 1921). The embrace of Northbourne and the perennialist philosophers of his day was, in many senses, the drop of water finding its way to the ocean. His son described it as an "event which changed his life" (James, 2008, p.xxii).

Meeting the perennialists led to Northbourne translating, from French to English, three substantial books on metaphysical topics by the leading perennialist philosophers of his day. Those books were: René Guénon's *The Reign of Quantity and the Signs of the Times* (1953); Frithjof Schuon's *Light on the Ancient Worlds* (1965); and Titus Burckhardt's *Sacred Art in East and West: Its Principles and Methods* (1967).

Northbourne published nine papers in the perennialist journal *Studies in Comparative Religion* in the years 1967 to 1974 (1967, 1969a, 1969b, 1971, 1972, 1973a, 1973b, 1974a, 1974b). In its predecessor, *Tomorrow, The Journal of Parapsychology, Cosmology and Traditional Studies*, he published at least one paper, in which he advised "see God in all things" (1964b, p.274), and one book review (1964a).

He published two further books, *Religion in the Modern World* (1963) and *Looking Back on Progress* (1970b). Of these two books, Lings & Minnaar state that: "His books *Religion in the Modern World* and *Looking Back on Progress* are considered by many to be amongst the most accessible introductions to the 'perennialist' or 'traditionalist' outlook, and exercised a considerable influence on E. F. Schumacher" (2007, p.333). Schumacher (1911-1977) was elected President of the Soil Association in 1970 and during his tenure with the Soil Association he published his influential book *Small is Beautiful: A study of economics as if people mattered* (Payne, 1971; Schumacher, 1973).

A recently published perennialist anthology, *The Underlying Religion: An introduction to the Perennial Philosophy*, is a collection of twenty four essays, of which three are authored by Northbourne (Lings & Minnaar, 2007). The title describes Perennialism as

the “underlying religion” and is congruent with Northbourne’s translation of *Light on the Ancient Worlds*, in which Schuon wrote of: “the ‘invisible’ or ‘underlying’ religion, the religio perrenis” (1965, p.143).

While Rudolf Seiner trod the path from metaphysics to agriculture (Wachsmuth, 1989), Northbourne traversed the same path, but in the opposite direction, although he never lost sight of agriculture (and of course, similarly, Steiner never lost sight of metaphysics). In Northbourne’s second book *Religion in the Modern World*, he wrote of “the fact that there is strictly speaking nothing … that has nothing to do with Religion, simply because there is nothing that has nothing to do with God” (Northbourne, 1963, p.18).

3.2 Food & Agriculture

During WWII, Northbourne was Chairman of the County War Agriculture Committee for Kent (James, 2008; Rowe, 1944). Before the war Britain had been heavily reliant on imported food. The objective of these committees was to boost local food production at a time when Allied shipping was under constant threat of attack and many ships with cargo and crew were lost. Northbourne had addressed the topic ”Where is the food to come from” in an address to the Economic Reform Club and Institute early in the war, raising his concerns that 56% of Britain’s food “at present” is imported (Northbourne, 1940d, p.3). Britain achieved dramatic increases in domestic food production during WWII, with the area under total tillage increasing 66%, achieving a wheat production increase of 83%, barley of 96%, and potatoes of 102%, in the period 1939-1944 (Harkness, 1945).

At one point during the war, Northbourne made representations for assistance on behalf of a German refugee family (Northbourne, 1942b). He participated through the war years in an informal agrarian group called the Kinship in Husbandry (1941-1947) which held meetings in Oxford and London (Paull, 2011b). Another wartime agrarian pursuit was an effort, ultimately unsuccessful, to have Ehrenfried Pfeiffer visit and relocate to Britain (Paull, 2011b).

Northbourne revisited agricultural topics throughout his life. He contributed a chapter “Health and Fertility” to Massingham’s *The Natural Order* published in 1945. He wrote there that: “the continued existence of all living creatures, man included, depends on the state of the soil which we know as fertility” (Northbourne, 1945, p.111). He asserted that: “soil fertility and health are not two things but one” (p.116). He lamented that for the reform of agriculture “the knowledge cannot be found within what is now the orthodox school of agricultural thought” (p.118). He declared that: “We must acquire a new sense of purpose, we must achieve a spiritual reorientation” (p.118). He observed that “a revolt is beginning” against industrial and chemical agriculture, and he viewed this as a “spiritual struggle” (p.119). He reiterated his earlier warning from *Look to the Land* that: “the strength of the forces that oppose it is enormous, so that the struggle must be long and hard” (p.119).

Northbourne wrote, in 1949, in praise of “a valley in France where the traditional methods of cultivation have largely survived, and where the crops produced form a striking commentary on more recent farming methods” (p.4). The following year he contributed the ‘Foreword’ to Philip Oyler’s book *The Generous Earth* (Northbourne, 1950).

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3.3 Wye College

Northbourne was Chairman of the Governing Body of Wye College from 1946 (Shrubsole, 1947). He was appointed a Governor of the College in 1925 and he retired as Chairman in 1965 (Richards, 1994). Wye College was a specialist agricultural college affiliated with the University of London, located in the village of Wye in Kent, and it possessed substantial adjacent farmland. In 2000 Wye College ceased to be an independent college of the University London, and it amalgamated with Imperial College, London (Burnham, 2007). For Wye College, this proved to be a fatal decision as Imperial closed the Wye campus at the end of 2008, and some years later a new tenant is still being sought by the property agent Savills (Jovanovic, 2014).

As the Chairman of the Governing Body, Northbourne presided over Wye College's 500th anniversary commemoration, 1447-1947, writing on that occasion:

> Agriculture and Horticulture are the most ancient of the arts and sciences, and their practice is still in the main founded on immemorial tradition; and rightly so, for we cannot afford to discard the accumulated wisdom of our forefathers … education means more than a mere absorption of technical knowledge, and that technical training need not be incompatible with the attainment of loftier aims (1947, p.3).

On Northbourne's retirement as Governor of Wye College, Hardy paid tribute to Northbourne's "long and distinguished record of voluntary service" in agriculture, education and agricultural education from 1925 to 1965 (1965, p.20). Acknowledging Northbourne's role at Wye College, Skilbeck recorded that: "He was a member of the Governing Body for forty years and its Chairman and Provost from 1946 to 1965" (1983, p.78). Skilbeck shared his fond memories of Northbourne:

> … we listened spellbound to his wise and so carefully considered addressees … it is more for his skills and his deep and lasting interests in so varying and widely ranging fields that he will be remembered with such affection … He was a man of great vision, decisiveness, quiet humour and kindly authority … one who brought to every facet of his widely ranging life a rare sense of harmony and balanced purpose. Above all he was a widely read man of very considerable scholarship with deep philosophical understanding … He belonged essentially to himself though sharing with his intimate friends his search for truth. He was a man of great faith and rare belief who saw 'through a glass darkly' so much more than is given to most of us to see and experience (1983, pp.78-79).

After forty years tenure on the Governing Board of Wye College, the agricultural arm of the University of London, and a quarter century after *Look to the Land*, Northbourne's chosen Fellowship Lecture topic at Wye College was "Religion and Science". He sought to stake out some intellectual ground for metaphysics, declaring to his audience that: "The rightful domain of science is that of the observable, and surely it ought to be enough, for it is inexhaustible, though so very far from being everything" (Northbourne, 1965, p.6).

3.4 Looking Back on Progress

Northbourne's third and final book, *Looking Back on Progress*, was published in 1970. Chapter 6 of this new book was *A Glance at Agriculture* which had first appeared the previous year in the perennialist journal *Studies in Comparative Religion* (1969a). Thirty years had, by then, elapsed since *Look to the Land*. The founding of the International Federation of Organic Agriculture Movements (IFOAM) in Paris was still two years into the future and was not a foreseen event (Paull, 2010).

Thirty years after *Look to the Land*, Northbourne observed that the organic movement of the day was still alight but not ablaze:

> A few people have tried and are still trying to produce food without the help of chemical fertilizers and sprays, and a few people - perhaps a growing number - prefer to buy food thus produced, and who dares to say that they are wrong? These counter-movements carry very little weight at present; a large majority of people are not interested and much prefer to swim with the stream, while dismissing the objectors to food grown by modern methods as being mere faddists (Northbourne, 1970b, p.80).

In *A Glance at Agriculture* (1970) he commented on the quickening pace of agricultural research and the inadequacy of safety testing regimes:

> There is no chance at all of assessing or anticipating long-term effects, simply because they can only be assessed at the end of a long term; there is simply not time to take more than the mostly obvious and immediate effects into account. The one thing we know about these long-term changes is how complex and unpredictable they are, and that they are often irreversible (1970, p.85).

Northbourne stated that "we are entitled to expect of our food something better than harmlessness" (1970, p.79). He was critical of "changes brought about in agriculture by the rise to dominance of the modern industrial outlook" (p.77). An issue specifically raised was: "the substitution of chemical methods for older methods, both for the maintenance of productivity of the soil and for combatting diseases, weeds and pests" (p.78). He also took exception to "the widespread practice of adding preservatives, and substitutes for perishable or costly ingredients, to a growing range of foods, to an extent that amounts to a more or less serious adulteration" (pp.78-79).

A Glance at Agriculture went beyond *Look to the Land* in three important ways. Northbourne added the "factory farming" of animals as an issue of concern in the emerging practices of modern food production. Anticipating genetic modification, and perhaps nanotechnology, Northbourne sounded two new warnings. He cautioned that: "genetics … offers possibilities of the artificial production of what would be in effect new species of plants and animals" (p.80), and he warned of: "how potentially dangerous to living creatures experiments on the structure of atoms can be" (p.85).

Looking Back on Progress was issued in 1970 in a Turkish language version and in an English-language version published in Pakistan in 1983 (Northbourne, 1970a, 1970c). Both these editions identify the author as "Lord Northbourne (Sidi Nuh)". The name in parentheses is an Arabic nom de plume. Nuh is the Arabic term for Noah; and Sidi is an

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Arabic honorific title approximating to ‘Lord’, ‘Sir’, ‘learned scholar’, or ‘from the line of the prophet’ (Debbarh, 2009). According to Professor Seyyed Nasr the name ‘Sidi Nuh’ was given to Lord Northbourne by “his Sufi master” (Nasr, 2009).

Concluding Remarks

Northbourne lived to see his framing of agriculture, as ‘organic versus chemical farming’, proliferate and take root internationally. When Blackburn issued his *Organic Husbandry, A Symposium* (1949), he reported ‘organic’ books, authors, associations and periodicals from around the world.

In 1972 five organics advocacy groups came together in Versailles, France, to found the International Federation of Organic Agriculture Movements (IFOAM), the umbrella organisation for the international advocacy and coordination of the organics sector (Paull, 2010). IFOAM have recently articulated four principles of organic agriculture, namely: Care, Health, Environment, and Health (IFOAM, 2006) (suggested mnemonic: CHEF). Each of these principles found expression in *Look to the Land* (see for example p.2; pp. 58-59; p.83; pp.141-142; p.149).

The organics meme has articulated into a US$64 billion per annum industry, with statistics on organic agriculture are now reported from 164 countries (Willer & Lernoud, 2014). In the process of this proliferation, ‘organic’ has coupled with fibres, floristry, forestry, and cosmetics, and this process of extension, coupling, and diffusion is actively continuing. Leadership in organic agriculture is now widely distributed around the globe (Paull, 2012).

Organic agriculture has evolved to move beyond the exclusions of synthetic fertilisers and pesticides, to also exclude genetically modified organisms (GMOs), food irradiation, cloned animals, and nanomaterials (e.g. BFA, 2010).

Northbourne’s holistic, non-dualist, view retains its vitality and salience:

> The world with its inhabitants is multiple, but by virtue of its origin in the divine Unity it constitutes a unity. Whatever may effect one part effects the whole, and whatever effects the whole effects every part (Northbourne, 1970b, p.87).

Northbourne’s three books are all now back in print, and a fresh compilation of his writings, *Of the Land & the Spirit: The Essential Lord Northbourne on Ecology and Religion* (James & Fitzgerald, 2008) makes a selection of his wisdom readily accessible once again.

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Archives, Dornach; the Biodynamic Association, Stroud; the Soil Association, Bristol; and the present Lord Northbourne (Walter James' son Christopher James).

References

Advertiser. (1940a). Books Received: General. Adelaide: The Advertiser. 13 July, p. 4.

Advertiser. (1940b). The Land Problem: 'Look to the Land' by Lord Northbourne. Adelaide: The Advertiser. 24 August, p. 10.

Balfour, E. B. (1943). The Living Soil: Evidence of the importance to human health of soil vitality, with special reference to post-war planning. London: Faber and Faber.

Balfour, E. B. (1945). Proposed Soil Association, Founders' Meeting. London: 5 pp. Typescript dated 27 June of Meeting 12 June; Soil Association Archives, Bristol, UK.

BFA. (2010). Australian Certified Organic Standard 2010 - Version: 1.0. Brisbane: Biological Farmers of Australia (BFA).

Blackburn, J. S. (Ed.). (1949). Organic Husbandry, A Symposium. London: Biotechnic Press.

Brander, M. (2003). Eve Balfour: Founder of the Soil Association & The Voice of the Organic Movement, A Biography. Haddington, UK.

Burckhardt, T. (1967). Sacred Art in East and West: Its Principles and Methods (Lord Northbourne, Trans.). London: Perennial Books.

Burke, B. (1938). Burke's Peerage, Baronetage and Knightage (Coronation Honours (96th) Edition). London: Shaw Publishing Co.

Burnham, P. (2007). The College at Wye: A Historical Guide. Wye: Wye Historical Society.

Charles, D. (2005). Master Mind: The rise and fall of Fritz Haber, the Nobel laureate who launched the age of chemical warfare. New York: Ecco, HarperCollins Publishers.

Conford, P. (2001). The Origins of the Organic Movement. Edinburgh: Floris Books.

Conford, P. (2002). Finance versus Farming: Rural Reconstruction and Economic Reform, 1894-1955. Rural History, 13(2), 225-241.

Craig, E. S., & Gibson, W. M. (Eds.). (1920). Oxford University Roll of Service. Oxford: Clarendon Press, Oxford University Press.

databaseOlympics.com. (2006). 1920 Summer Olympics, Antwerp, Belgium, Rowing: www.databaseOlympics.com.

Debbarh, E. H. (2009). personal communication. Sufi scholar: The Tariqa Tijaniyya.

Douglas, F. C. R. (1946). Memorandum and Articles of Association of The Soil Association, Ltd. 12 pp.; London: F. C. R. Douglas, Solicitor.

Gardiner, R. (1943). England Herself: Ventures in Rural Restoration. London: Faber and Faber Ltd.

Guénon, R. (1953). The Reign of Quantity and the Signs of the Times (Lord Northbourne trans. from the 1945 French original). London: Luzac & Company.

Hammerton, J. (Ed.). (1940). The War Illustrated v.3 No.45. London: The War Illustrated.

Hardy, E. (1965). The Right Hon. Lord Northbourne. Wye: The Journal of the Agricola Club and Swanley Guild, 6(2), 20-21.

Harkness, D. A. E. (1945). A Tract on Agricultural Policy. London: P. S. King and Staples Limited.

 ISSN 1177-4258

Hatfield, P. (2008). Personal communication. College Archivist, Eton College: Windsor.

Heckman, J. (2006). A history of organic farming: Transitions from Sir Albert Howard's 'War in the Soil' to USDA National Organic Program. Renewable Agriculture and Food Systems, 21(3), 143-150.

Hicks, C. S. (1945). Soil, Food and Life (The Annie B. Cunning Lectures on Nutrition, No. 3, University of Melbourne). [Melbourne]: The Royal Australasian College of Physicians.

Hobson, S. G. (1936). Functional Socialism. London: Stanley Nott.

Hobson, S. G. (1938). Pilgrim to the Left - Memoirs of a Modern Revolutionist. London: Edward Arnold & Co.

House of Lords. (1934). Die Mercurii, 20° Junii 1934. Journals of the House of Lords, CLXVI(Q 3).

House of Lords. (1936). 21° Januarii 1936. Journals of the House of Lords, CLXVIII, 52.

House of Lords. (1937). Die Jovis, 25° Februarii 1937. Journals of the House of Lords, CLXIX, 126.

Howard, A., & Wad, Y. D. (1931). The Waste Products of Agriculture: Their Utilization as Humus. Bombay: Humphrey Milford, Oxford University Press.

Howard, L. E. (1954). Sir Albert Howard in India. Emmaus,PA: Rodale Press.

Hutchins, R. (1993). Well Rowed Magdalen: A History of Magdalen College Boat Club 1859-1993. Oxford: Magdalen College.

Huxley, A. (1946). The Perennial Philosophy. London: Chatto & Windus.

IFOAM. (2006). Principles of Organic Agriculture. Bonn: International Federation of Organic Agriculture Movements (IFOAM).

ISIS. (1920). Varsity Sport. The Isis (558), 9.

ISIS. (1921). ISIS Idol: W.E.C. James (Magdalen) (President, O.U.B.C., 1920-1921). The Isis (556), 3.

Jackson, C. (1974). J. I. Rodale: Apostle of Nonconformity. New York: Pyramid Books.

James, C. (2008). Introduction. In C. James & J. A. Fitzgerald (Eds.). Of the Land & the Spirit: The Essential Lord Northbourne on Ecology and Religion. Bloomington, IN: World Wisdom.

James, C., & Fitzgerald, J. A. (Eds.). (2008). Of the Land & the Spirit: The Essential Lord Northbourne on Ecology and Religion. Bloomington, IN: World Wisdom.

James, W. E. C. (1919). MS handwritten form: Candidate for Matriculation. Oxford: University of Oxford Archives, UR1/1/71.

Jovanovic, C. (2014). Wye Campus. London: Imperial College.

King, F. H. (1911). Farmers of Forty Centuries, or Permanent Agriculture in China, Korea and Japan (Edited by Professor J.P. Bruce). Madison, Wisconsin: Mrs. F. H. King.

Koepf, H. H. (1991). *Ehrenfried Pfeiffer: Pioneer in Agriculture and Natural Sciences*. Kimberton, USA: Bio-Dynamic Farming and Gardening Association Inc.

Lings, M., & Minnaar, C. (Eds.). (2007). The Underlying Religion: An introduction to the Perennial Philosophy. Bloomington, IN: World Wisdom, Inc.

Lockeretz, W. (Ed.). (2007). Organic Farming: An International History. Wallingford, UK: CABI.

Lymington, Viscount (1943). Alternative to Death: The Relationship between Soil, Family and Community. London: Faber and Faber.

Mackenzie, M. (1922). *Spiritual Values in Education & Social Life* (Conference programme; 8 pp.). Oxford: Oxford Holiday Conference, August 15th to 29th.

Magdalen College. (1922). The Magdalen College Register (1922). Oxford: Magdalen College, Oxford University.

Magdalen College. (1934). The Magdalen College Register (1934). Oxford: Magdalen College, Oxford University.

Magdalen College. (1939). The Magdalen College Register (1939). Oxford: Magdalen College, Oxford University.

Magdalen College. (1979). The Magdalen College Register (1979) (Seventh issue). Oxford: Magdalen College, Oxford University.

Massingham, H. J. (1941). Introduction. In H. J. Massingham, England and the Farmer (pp. 1-11). London: B. T. Batsford.

Massingham, H. J. (1944). Introduction. In H. J. Massingham, The Natural Order: Essays in the Return to Husbandry (1945, pp. 1-19). London: J.M. Dent & Sons.

Massingham, H. J. (Ed.). (1945). The Natural Order: Essays in the Return to Husbandry. London: J.M. Dent & Sons.

Mitchell, E. (1946). Soil and Civilization. Sydney: Angus and Robertson.

Morrow, E. (1984). A History of Swanley Horticultural College. Wye, Kent.

Nasr, S. H. (2009). personal communication 8/7/2009. Washington: George Washington University.

Northbourne, Lord. (1934). School-Leaving Age. Hansard, 93, 484-486.

Northbourne, Lord. (1938a). MS handwritten letter 19/11/1938 ("Dear Lymington"; 19/11/1938; 2pp; 15M84/F209/4, Archives, Hampshire Record Office, WInchester). Northbourne Court, Deal, Kent.

Northbourne, Lord. (1938b). MS typewritten letter 2/10/1938 ("Dear Lymington"; 1p; 15M84/F209/8, Archives, Hampshire Record Office, WInchester). Northbourne Court, Deal, Kent.

Northbourne, Lord. (1938c). A Plain Approach to World Economy. The Present Age, May, 3(5), 51-59.

Northbourne, Lord. (1939a). The Betteshanger Summer School. News Sheet of the Bio-Dynamic Method of Agriculture, 9, 8-11.

Northbourne, Lord. (1939b). MS signed typescript letter 25/1/1939 ("Dear Lymington"; 25/1/1939; 2pp; 15M84/F209/3, Archives, Hampshire Record Office, WInchester). Northbourne Court, Deal, Kent.

Northbourne, Lord. (1940a). Look to the Land. London: Dent.

Northbourne, Lord. (1940b). Look to the Land (Club edition) ("eleventh of the Basis Books programme and is sold to members only"; "by arrangement with J. M. Dent & Sons Ltd"). London: Basis Books.

Northbourne, Lord. (1940c). Look to the Land (Second edition) ("Second, revised special edition"; 2003). Hillsdale, New York: Sophia Perennis.

Northbourne, Lord. (1940d). Where is the food to come from? In Three Addresses on Food Production in Relation to Economic Reform (pp. 3-9). London: The Economic Reform Club and Institute.

Northbourne, Lord. (1942a). Farm Management (Fertility and Health) (A 'Kinship in Husbandry' meeting; Oxford; 1/3/1942; pp.4-7; Typescript; Bryant E51, Liddell Hart Centre for Military Archives, Kings College, London). Merton College, Oxford.

Northbourne, Lord. (1942b). MS typewritten letter 21/1/1942 ("My dear Gerard"; 1p; 15M84/F240/14, Archives, Hampshire Record Office, WInchester). Coldharbour, Northbourne Court, Deal, Kent.

Northbourne, Lord. (1945). Health and Fertility. In H. J. Massingham, The Natural Order: Essays in the Return to Husbandry by Fourteen Writers (pp. 111-119). London: J.M. Dent & Sons.

Northbourne, Lord. (1947). Wye College 1447-1947. Wye: Wye College.

Northbourne, Lord. (1948). Let Us Get Back to Earth. Bio-Dynamics, 7(1), 31-32.

Northbourne, Lord. (1949). Peasant Farming in the Dordogne Valley. Wye, The Journal of the Wye College Association, 1(2), 4-8.

Northbourne, Lord. (1950). Foreword. In P. Oyler (Ed.), The Generous Earth (pp. 9-15). London: Hodder and Stoughton.

Northbourne, Lord. (1963). Religion in the Modern World. London: J. M. Dent & Sons.

Northbourne, Lord. (1964a). Book Reviews: Physique Moderne et Realite by Maurice Ollivier, Les Editions du Cédre, Paris. Tomorrow, Journal of Parapsychology, Cosmology and Traditional Studies, 12(4), 329-331.

Northbourne, Lord. (1964b). Pictures of the universe. Tomorrow, Journal of Parapsychology, Cosmology and Traditional Studies, 12(4), 267-278.

Northbourne, Lord. (1965). Religion and Science (Fellowship Lecture, Occasional Publication No. 13). Wye, Kent: Wye College, London University.

Northbourne, Lord. (1967). With God all things are possible. Studies in Comparative Religion 1(3), 99-104.

Northbourne, Lord. (1969a). A Glance at Agriculture. Studies in Comparative Religion, 3(1), 13-27.

Northbourne, Lord. (1969b). Religion and Science. Studies in Comparative Religion, 3(4), 225-238.

Northbourne, Lord. (1970a). Ilerlemeye Farkli Bir Bakiş (Turkish language edition of Looking Back on Progress; 1980; Trans Deniz Özer). Istanbul: Insan Yayinlari.

Northbourne, Lord. (1970b). Looking Back on Progress. London: Perennial Books.

Northbourne, Lord. (1970c). Looking Back on Progress (limited edition) (1983). Lahore, Pakistan: Suhail Academy.

Northbourne, Lord. (1971). Intellectual Freedom. Studies in Comparative Religion, 5(1), 34-45.

Northbourne, Lord. (1972). Chance. Studies in Comparative Religion, 6(1), 22-30.

Northbourne, Lord. (1973a). A note on Truth, Beauty and Goodness. Studies in Comparative Religion, 7(2), 107-112.

Northbourne, Lord. (1973b). The Survival of Civilization. Studies in Comparative Religion, 7(1), 21-30.

Northbourne, Lord. (1974a). A Cross Awry. Studies in Comparative Religion, 8(2), 89-95.

Northbourne, Lord. (1974b). The New Eschatology. Studies in Comparative Religion, 8(1), 33-39.

Paull, J. (2006). The farm as organism: the foundational idea of organic agriculture. Journal of Bio-Dynamics Tasmania, (80), 14-18.

Paull, J. (2008). The lost history of organic farming in Australia. Journal of Organic Systems, 3(2), 2-17.

Paull, J. (2010). From France to the World: The International Federation of Organic Agriculture Movements (IFOAM). Journal of Social Research & Policy, 1(2), 93-102.

Paull, J. (2011a). Attending the first organic agriculture course: Rudolf Steiner's Agriculture Course at Koberwitz, 1924. European Journal of Social Sciences, 21(1), 64-70.

Paull, J. (2011b). The Betteshanger Summer School: Missing link between biodynamic agriculture and organic farming. Journal of Organic Systems, 6(2), 13-26.

Paull, J. (2011c). Biodynamic Agriculture: The journey from Koberwitz to the World, 1924-1938. Journal of Organic Systems, 6(1), 27-41.

Paull, J. (2011d). The making of an agricultural classic: Farmers of Forty Centuries or Permanent Agriculture in China, Korea and Japan, 1911-2011. Agricultural Sciences, 2(3), 175-180.

Paull, J. (2011e). Rudolf Steiner and the Oxford Conference: The birth of Waldorf education in Britain. European Journal of Educational Studies, 3(1), 53-66.

Paull, J. (2011f). The secrets of Koberwitz: The diffusion of Rudolf Steiner's Agriculture Course and the founding of Biodynamic Agriculture. Journal of Social Research & Policy, 2(1), 19-29.

Paull, J. (2012). Organics Olympiad 2012: Global Indices of Leadership in Organic Agriculture. Organic News, 26 July, 2 August, 9 August.

Paull, J. (2013). A history of the organic agriculture movement in Australia. In B. Mascitelli & A. Lobo (Eds.). Organics in the Global Food Chain (pp. 37-60). Ballarat: Connor Court Publishing.

Payne, V. (1971). A History of the Soil Association (MA thesis). Manchester: University of Manchester.

Petre, A. (2008). Personal communication. Archives, University of Oxford: Oxford.

Pfeiffer, E. (1938). Bio-Dynamic Farming and Gardening: Soil Fertility Renewal and Preservation (F. Heckel, Trans.). New York: Anthroposophic Press.

Pfeiffer, E. (1938). Soil Fertility, Renewal & Preservation: Biodynamic Farming and Gardening (1947 edition; first thus with the original title and subtitle interchanged). London: Faber and Faber.

Pfeiffer, E. (1983). Bio-Dynamic Gardening and Farming (Vol. 1). Spring Valley, New York: Mercury Press.

Pfeiffer, E. E. (1952). The organic-chemical controversy in agriculture. Bio-Dynamics, X(3), 2-19.

Pollan, M. (2006). The Omnivore's Dilemma: The Search for a Perfect Meal in a Fast-Food World. London: Bloomsbury.

Portsmouth, Earl of (1965). A Knot of Roots. London: Geoffrey Bles.

Richards, S. (1994). Wye College and its World: A Centenary History. Wye: Wye College Press.

Rodale, J. I. (Ed.). (1942). Organic Farming and Gardening. Emmaus, Pennsylvania: Rodale Press, 1(1):1-16.

Rowe, R. (1944). The Economic Reform Club and Institute, What it is - and What it does. London: Economic Reform Club and Institute.

Schmitt, C. B. (1966). Perennial Philosophy: From Agostino Steuco to Leibniz. Journal of the History of Ideas, 27(4), 505-532.

Schumacher, E. F. (1973). Small is Beautiful: A study of economics as if people mattered. London: Blond & Briggs.

Schuon, F. (1965). Light on the Ancient Worlds (Lord Northbourne, Trans.). London: Perennial Books.

Scofield, A. M. (1986). Organic farming - the origin of the name. Biological Agriculture and Horticulture, 4, 1-5.

Shrubsole, H. C. (1947). Report of the Annual Meeting held at Y.W.C.A. The Swanley Magazine, VI(15), 4-5.

Silver, L. M. (2006). Challenging Nature: The Clash of Science and Spirituality at the New Frontiers of Life. New York: HarperCollins.

Skilbeck, D. (1983). Lord Northbourne. Wye: The Journal of the Agricola Club and Swanley Guild, 12(1), 78-79.

Smil, V. (2001). Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production. Cambridge, USA: The MIT Press.

SMH. (1940). Land-Love: "Look to the Land" by Lord Northbourne. Sydney: The Sydney Morning Herald (SMH). 21 September, p. 10.

Steiner, R. (1924). Agriculture Course ("Printed for private circulation only"; 1929, first English language edition; George Kaufmann Trans). Dornach, Switzerland: Goetheanum.

The Field. (1940). New Books: Are We Misusing Our Heritage? 'Look to the Land' by Lord Northbourne, Dent, 7/6. The Field, CLXXV(4566), 1004.

Tyack, G. (1998). Oxford, An Architectural Guide. Oxford: Oxford University Press.

University of Oxford. (c.1920). Student card: James, Hon. W.E.C. (Department of Agriculture). Oxford: University of Oxford Archives, AG 1/2.

von Eckardt, H., & 42 others. (1925). Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare. Geneva.

Wachsmuth, G. (1989). The Life and Work of Rudolf Steiner (O. D. Wannamaker & R. E. Raab, Trans. 2nd edition; first published in German 1941). Blauvert, NY: Spiritual Science Library.

Werner, U. (1999). Anthroposophen in der Zeit der Nationalsozialismus 1933-1945. Muenchen: Verlag R. Oldenberg.

Willer, H., & Lernoud, J. (Eds.). (2014). The World of Organic Agriculture: Statistics and Emerging Trends 2014: Frick, Switzerland: Research Institute of Organic Agriculture (FiBL) & Bonn: International Federation of Organic Agriculture Movements (IFOAM).

Wrench, G. T. (1946). Reconstruction by Way of the Soil. London: Faber and Faber.

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