Research article

Awareness of Organic Vegetable Production Practices in West Java and Bali, Indonesia

CHIFUMI TAKAGI
International Rice Research Institute, Makassar, Sulawesi Selatan, 90213, Indonesia
Email: c.takagi@irri.org, takagich@msu.edu

MURARI SUVEDI
Michigan State University, Michigan, USA

Received 16 December 2010 Accepted 21 February 2011

Abstract One of the challenges in developing organic agricultural production in Indonesia is increasing farmers' awareness of organic farming methods to grow high quality organic products. Recognizing the need for research and development of organic agriculture, the Development of New Bio-Agents for Alternative Farming (DNBAF) project established pilot farms in West Java and Bali in 2005 in order to field test the use of bio-pesticides and compost. Since lack of extension is a constraint in developing organic agriculture in Indonesia, it is important to understand what factors determine farmers' knowledge of organic farming methods. The goal of this study was to determine the factors associated with awareness of organic vegetable production practices including bio-pesticides and compost in West Java and Bali, Indonesia. The study tested the hypothesis that socio-economic variables affect the farmers' familiarity with bio-pesticides and compost. The socio-economic variables examined were: respondent's location, gender, age, education level, household size, number of family laborers, farming experience, farm size, distance to the pilot farm, irrigation sources, land tenure status, net revenue of cabbage, tomato, carrot production, exposure to the pilot farm and any information source groups (media, extension, farmer and commercial groups). Data were collected using a face-to-face survey. In the survey, a total of 627 households of vegetable farmers surrounding the pilot farms in West Java and Bali constituted the population, and 210 farmers selected by a systematic random sampling method were interviewed. The study hypothesis was tested by a binary logit analysis. The binary logit analysis showed that the factors associated with awareness of the practices included: location, gender, educational level, distance to the pilot farms, exposure to the pilot farms, and information sources.

Keywords organic agriculture, bio-pesticide, compost, socio-economic, binary logit analysis

INTRODUCTION

Vegetable production is an important agricultural sub-sector in Indonesia. In recent decades, due to a rapid increase and diversification in demand for fresh vegetables, production of temperate vegetables has drastically increased in the upland areas of the major islands including Java and Sumatera. For farmers, growing temperate vegetables has great potential for increasing their income (Fujimoto and Miyaura, 1997).

Historically, the golden era of agricultural extension in Indonesia was the Green Revolution program, and at this time agricultural extension played a pivotal role in increasing production of rice (Mundy, 1992). Although the agricultural extension system played an important role in the development of agriculture, lack of sufficient management and the huge institutional inertia of a large extension bureaucracy considerably weakened the system. Because of weakening financial and technical support, extension services virtually collapsed (Sulaiman and Hall, 2004). In the 1990s, the Ministry of Agriculture moved toward decentralization to ensure effectiveness, increase accountability to farmers, and reduce costs to the central government. Many districts dissolved their old extension systems and set up new extension structures based on the needs of regional farming conditions (Zakaria, 2003). One result of this decentralization was the elimination of governmental subsidies for chemical fertilizers and pesticides, which increased their cost to farmers, and consequently decreased their use. This increased cost of chemical fertilizers and pesticides boosted interest in integrated pest management and non-chemical alternative technologies, such as organic agriculture[*] (Johnson, et al., 2008).

In 1997 the soaring cost of agricultural inputs precipitated by the monetary crisis induced many farmers to switch to organic methods (Prawoto and Suyono, 2005). Following this organic agriculture movement, the government issued the National Standard for Organic Food (SNI 01-6729-2002) adopted from the Codex CAC-GL 32/1999 in 2002. However, research and development activities related to organic agriculture in the country have been largely lacking (Prawoto and Suyono, 2005).

Recognizing the need for research and development of organic vegetable production, the Development of New Bio-Agents for Alternative Farming (DNBAF) project established pilot farms in West Java and Bali in 2005 in order to field test the application of biological insecticides (bio-pesticides) and the use of organic fertilizers (compost).

One of the challenges in developing organic farming in Indonesia is increasing farmers' knowledge of organic farming methods to grow high quality organic products (Surono, 2007). As a result of an agricultural extension process, farmers may adopt a new technology. The farmers will obtain enough knowledge of the technology through communication and education processes. Through these processes, farmers will form an attitude toward the technology, and can decide whether they will adopt the technology or not. If the farmers decide to adopt the technology, it will be implemented (Rogers, 1995). Since lack of extension is a constraint in organic agriculture in Indonesia, at the first step, it is very important to understand what factors determine farmers' knowledge of organic farming methods. However, until 2007, no systematic technology adoption study of the organic conversion process had been conducted in Indonesia.

Since the DNBAF project is an example of organic conversion, this study investigated farmers' knowledge of organic farming methods, including use of bio-pesticides and compost on three vegetable crops – cabbage, tomato, and carrot. The three crops were the major vegetables grown in the project sites. The study was conducted in two communities surrounding the pilot farms: Sukagalih village, sub-district of Megamedung, district of Bogor in West Java and Bangli village, sub-district of Baturiti, district of Tabanang in Bali.

METHODOLOGY

Data were collected using a face-to-face survey from July to October 2007. In the survey, a total of 627 households of vegetable farmers surrounding the pilot farms in West Java and Bali constituted the population, and 210 farmers selected by a systematic random sampling method were interviewed. This study tested the hypothesis that socio-economic variables affect the farmers' familiarity with bio-pesticides and compost. The socio-economic variables examined were: respondent's location, gender, age, education level, household size, number of family laborers, farming experience, farm size, distance to the pilot farm, irrigation sources, land tenure status, net revenue of cabbage, tomato, carrot production, exposure to the pilot farm and any information source groups (media, extension, farmer and commercial groups). These variables were identified based on Padel's (2001) organic conversion model and a literature review of organic vegetable production in Indonesia (Sudana, et al., 2003; Syaukat, 2003; Dadang, et al., 2005; Sumiartha, et al., 2005; Dadang, et al., 2006; Syaukat, 2006) . The study hypothesis was tested by a binary logit

[*] *Organic agriculture is defined by the Secretariat of the Joint FAO/WHO Food Standards Program (Codex CAC-GL 32/1999) as "holistic production management systems which promote and enhance agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, cultural, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system" (p.3).*

analysis, which is commonly used to analyze the factors influencing decision making in the field of agriculture, such as adoption of new technologies (Cavane, 2007; Banerjee, et al., 2008; Zhou, et al., 2008). The statistical software SPSS was used for the analysis. Definitions of variables used in the logit model are listed in Table 1. Two dichotomous dependent variables were:(1) familiarity with bio-pesticides is a dependent variable if respondent is familiar with bio-pesticides = 1 and if not familiar = 0 (F_BIO); (2) familiarity with compost is a dependent variable if respondent is familiar with compost = 1 and if not familiar = 0 (F_COMP).

Table 1 Variables definition in the binary logit model

Variables	Definition
Dependent Variables	
F_BIO	Familiarity with bio-pesticides (familiar = 1, not familiar = 0)
F_COMP	Familiarity with compost (familiar = 1, not familiar = 0)
Explanatory Variables	
LOCA	Location of respondent (West Java = 1, Bali = 0)
GEN	Gender of respondent (male = 1, female = 0)
AGE	Age of respondent (year)
EDU2	Education level of respondent (some primary school = 1, other = 0)
EDU3	Education level of respondent (completed primary school = 1, other = 0)
EDU4	Education level of respondent (completed junior high school = 1, other = 0)
EDU5	Education level of respondent (completed high school = 1, other = 0)
HS	Household size of respondent
FL	Number of farming labor force in a household
EXPERIENCE	Farming experience of respondent (year)
FARM	Area of the farm (unit: are; 1 ha = 100 a)
DIS	Distance from respondent's house to the pilot farm (km)
DIRR	Irrigation dummy (have irrigation = 1, no irrigation = 0)
DLAND	Land tenure dummy (secure land tenure = 1, unscure land tenure = 0)
CNETREV	Net revenue of cabbage production (thousand rupia / 0.5 ha)
TNETREV	Net revenue of tomato production (thousand rupia / 0.5 ha)
WNETREV	Net revenue of carrot production (thousand rupia / 0.5 ha)
EXPO	Total number of "exposure question" checks
IFG_MEDIA	Total number of "information source question" checks: TV, radio, magazine/journal, internet (media information group)
IFG_EXTEN	Total number of "information source question" checks: extension agent, NGO, university (extension information group)
IFG_FARMER	Total number of "information source question" checks: farmers' group, organic farmers, other farmers, family member, self-study (farmer information group)
IFG_COMMER	Total number of "information source" checks: market people, commercial company/agricultural retail store (commercial information group)

Note: EDU variables compare familiarity with bio-pesticides relative to vegetable farmers with educational level of no schooling (EDU1).

Explanatory variables include location of respondent (LOCA), gender of respondent (GEN), age of respondent (AGE), five dummies for education level (EDU), household size of respondent (HS), number of farming family labor (FL), farming experience of respondent (EXPERIENCE), area of the farm (FARM), distance from respondent's house to the pilot farm (DIS), irrigation dummy variable if respondent has an irrigation = 1 and if no irrigation = 0 (DIRR), land tenure status dummy if respondent has secure land tenure = 1 and if unsecure land tenure = 0 (DLAND), net revenue of cabbage production in Indonesian rupiah per 0.5 hectare (CNETREV), net revenue of tomato production in Indonesian rupiah per 0.5 hectare (TNETREV), net revenue of carrot production in Indonesian rupiah per 0.5 hectare (WNETREV), total number of "information source question" checks for media information source group including TV, radio, magazine/journal and internet (IFG_MEDIA), total number of "information source question" checks for extension information group including extension agent, NGO, university (IFG_EXTEN), total number of "information source question" checks for farmer information source group including farmers' group, organic farmers, other farmers, family member and self-study (IFG_FARMER) and total number of "information source" checks for commercial information source group including market people, commercial company/agricultural retail store (IFG_COMMER). In addition, variable of exposure to the pilot farm was identified as total number of "exposure question" checks (EXPO).

RESULTS

The coefficients, their standard errors, significance levels and odds ratio for bio-pesticides are listed in Table 2. The likelihood ratio test suggests the estimated model had a good fit with a statistically significant score of 192.15 at the 1 percent level. The McFadden R^2, a pseudo R-square, was 0.294, which falls in the range 0.2 to 0.4 that is considered an "extremely good fit" (Hensher and Johnson, 1981). Prediction success statistics indicated that the model correctly predicted about 76.6 percent of the responses.

The results of Table 2 identified no significant influences of any variables except exposure to the pilot farm (EXPO), educational level equaling completed primary school (EDU3), educational level equaling completed junior high school (EDU4) and distance from respondent's house to the pilot farm (DIS) for the probability of familiarity with bio-pesticides.

Tables 2 Estimated coefficients of the binary logit model for familiarity of bio-pesticide

Variables	B	S.E.	Wald	Sig.	Exp(B)
LOCA	1.204	0.733	2.697	0.101	3.332
GEN	20.194	11838.243	0.000	0.999	589042554.824
AGE	0.005	0.021	0.054	0.816	1.005
EDU2	1.239	0.759	2.666	0.103	3.453
EDU3**	1.729	0.872	3.930	0.047	5.637
EDU4**	2.392	1.087	4.846	0.028	10.938
EDU5	1.495	1.209	1.531	0.216	4.461
HS	0.167	0.146	1.301	0.254	1.182
FL	-0.111	0.310	0.128	0.720	0.895
EXPERIENCE	0.009	0.023	0.163	0.686	1.009
FARM	0.001	0.003	0.244	0.621	1.001
DIS*	-0.433	0.253	2.938	0.087	0.648
DIRR	-0.660	0.574	1.322	0.250	0.517
DLAND	-0.210	0.488	0.186	0.667	0.810
CNETREV	0.000	0.000	0.332	0.564	1.000
TNETREV	0.000	0.000	0.127	0.722	1.000
WNETREV	0.000	0.000	0.918	0.338	1.000
EXPO***	0.551	0.183	9.026	0.003	1.734
IFG_MEDIA	-0.029	0.267	0.011	0.915	0.972
IFG_EXTEN	0.003	0.403	0.000	0.993	1.003
IFG_FARMER	0.191	0.333	0.328	0.567	1.210
IFG_COMMER	0.244	0.386	0.400	0.527	1.277
Constant	-23.155	11838.243	0.000	0.998	0.000

*Note: Likelihood ratio test: χ^2 = 192.152 (d.f. = 22); critical χ^2 = 33.92; p > χ^2: < 0.0001. McFadden R^2 = 0.294. The percent correct classification is 76.6 %. Number of observations = 210. ***, ** and * indicate statistical significant P<0.01, P<0.05, and P<0.10, respectively. EDU variables compare familiarity with bio-pesticides relative to vegetable farmers with an educational level of no school (EDU1). A positive sign on any of the educational dummies would mean that farmers in that particular educational category had a higher probability of being familiar with bio-pesticides than farmers with an educational level of no school.*

Exposure to the pilot farm (EXPO) had a significant positive effect at the 1 percent level in the model, indicating that vegetable farmers who knew about the pilot farm had higher probabilities of being familiar with bio-pesticides than farmers who did not know about the pilot farm. In addition, the positive coefficients of the educational level of completed primary school (EDU3) and the educational level of completed junior high school (EDU4) were significantly different from zero at the 5 percent level. The odds ratio of DEU3 indicated that farmers who had completed primary school had about six times higher probability of being familiar with bio-pesticides, compared to the farmers who never went to school. Also, the odds ratio of DEU4 indicated that farmers who had completed junior high school had about eleven times higher probability of being familiar with bio-pesticides, compared to the farmers who never went to school. Moreover, the negative coefficient of distance from respondent's house to the pilot farm (DIS) was significantly different from zero at the 10 percent level. This was interpreted to indicate that farmers who lived closer to the pilot farm had a higher probability of being familiar with bio-pesticides rather than those who lived far from the pilot farm.

Table 3 shows the coefficients, their standard errors, significance levels and odds ratio for compost. The likelihood ratio test suggests the estimated model had a good fit with a statistically significant score of 209.116 at the 1 percent level. The McFadden R^2, a pseudo R-square, was 0.218, which falls in the range 0.2 to 0.4 that is considered an "extremely good fit" (Hensher and Johnson, 1981). Prediction success statistics indicated that the model correctly predicted 72.6 percent of the responses.

Table 3 Estimated coefficients of the binary logit model for familiarity of compost

Variables	B	S.E.	Wald	Sig.	Exp(B)
LOCA*	1.329	0.710	3.509	0.061	3.779
GEN*	1.730	0.898	3.716	0.054	5.643
AGE	0.013	0.020	0.399	0.527	1.013
EDU2	-0.317	0.664	0.228	0.633	0.728
EDU3	-0.263	0.731	0.129	0.719	0.769
EDU4	0.853	0.920	0.860	0.354	2.347
EDU5	1.598	1.197	1.782	0.182	4.944
HS	0.010	0.143	0.005	0.946	1.010
FL	0.090	0.284	0.100	0.752	1.094
EXPERIENCE	-0.016	0.021	0.552	0.457	0.984
FARM	0.001	0.003	0.043	0.836	1.001
DIS	-0.029	0.224	0.016	0.899	0.972
DIRR	-0.316	0.584	0.293	0.588	0.729
DLAND	0.213	0.482	0.195	0.659	1.237
CNETREV*	0.000	0.000	3.514	0.061	1.000
TNETREV	0.000	0.000	0.843	0.359	1.000
WNETREV	0.000	0.000	2.604	0.107	1.000
EXPO**	0.464	0.216	4.616	0.032	1.591
IFG_MEDIA	0.163	0.284	0.332	0.564	1.178
IFG_EXTEN	0.430	0.411	1.092	0.296	1.537
IFG_FARMER	0.143	0.340	0.178	0.673	1.154
IFG_COMMER*	0.644	0.359	3.206	0.073	1.903
Constant*	-3.113	1.640	3.603	0.058	0.044

Note: Likelihood ratio test: χ^2 = 209.116 (d.f. = 22); critical χ^2 = 33.92; p > χ^2: < 0.0001.
McFadden R^2 = 0.218.
*The percent correct classification is 72.6 %. Number of observations = 210. ***, ** and * indicate statistical significant P<0.01, P<0.05, and P<0.10, respectively. EDU variables compare familiarity with bio-pesticides relative to vegetable farmers with an educational level of no school (EDU1). A positive sign on any of the educational dummies would mean that farmers in that particular educational category had a higher probability of being familiar with compost than farmers with an educational level of no school.*

The results of Table 3 identified no significant influences of any variables except exposure to the pilot farm (EXPO), location of respondent (LOCA), gender of respondent (GEN), net revenue of cabbage production (CNETREV), total number of "information source" checks for the commercial information source group (IFG_COMMER), and the constant on the probability of being familiar with compost.

Exposure to the pilot farm (EXPO) had a significant positive effect at the 5 percent level in the model, indicating that vegetable farmers who were exposed to the pilot farm had higher probabilities of being familiar with compost than farmers who were not exposed to the pilot farm. In addition, the positive coefficients of the location of respondent (LOCA) and gender of respondent (GEN) were significantly different from zero at the 10 percent level. According to the odds ratio of LOCA, farmers in West Java had about a four times higher probability of being familiar with compost than farmers in Bali. According to the odds ratio of GEN, male farmers had about a six times higher probability of being familiar with compost than female farmers. Moreover, the positive coefficient of net revenue of cabbage production (CNETREV) was significantly different from zero at the 10 percent level. However, the coefficients of CNETREV were zero because their frequencies were small; thus there was no influence on the familiarity with compost. The positive coefficient of total number of "information source" checks for commercial information source group (IFG_COMMER) was significantly different from zero at the 10 percent level. This was interpreted to indicate that farmers who obtained information for their vegetable production from market people and commercial company/agricultural retail stores (commercial information group) had higher probability of being familiar with compost than those who did not obtain information from the commercial information group. Finally, the negative coefficient of constant was significantly different from zero at the 10 percent level, but this interpretation of the intercept might not have any real meaning (Gujarati, 1995).

DISCUSSION

The analysis showed that an educational level of at least primary school (EDU3 and EDU4) and distance from respondent's house to the pilot farm (DIS) were associated with increasing farmers' awareness of bio-pesticide (Table 2) but there was no significant influence of educational level on the farmers' awareness of compost (Table 3). One of the possible reasons for this disparity is that use of compost might be recognized as a traditional technology and use of bio-pesticide might be recognized as a modern-new technology of organic farming by the vegetable farmers. For the farmers, they might be able to learn a new technology easily from their experiences despite the lack of a higher educational background if it was based on a traditional technology because they might have experience in using a similar form technology. However, if the new technology is a modern-new technology, it might be more difficult to learn because of lack of experience. To understand the modern-new technology, farmers may need guidance by agricultural specialists, observable concrete examples and basic knowledge of the technology.

Location of respondent (LOCA) and gender of respondent (GEN) were associated with increasing farmers' awareness of compost (Table 3) while there was no significant influence of the location on the farmers' awareness of bio-pesticide (Table 2). One of the possible reasons for this result is that the uneven gender balance in the respondents between West Java and Bali. All respondents in West Java were male. Most respondents in Bali (89.3 percent) were also male. One of the main reasons for the predominance of male respondents was that the study sites were in rural Indonesia, where the societies are male-centered, conservative, and have heavy religious influences from both Islam and Hindu faiths. When the researcher developed a list of respondents, all were male heads of households in West Java, and male heads of households also predominated in Bali. The researcher explored who was really involved in vegetable farming in a respondent's household during a short conversation before the actual interviews, and this was what the actual collected data showed.

CONCLUSION

The results indicated no significant influence of any of the variables, except exposure to the pilot farm (EXPO), educational level of completed primary school (EDU3), educational level of completed junior high school (EDU4) and distance from respondent's house to the pilot farm (DIS) on the probability of being familiar with bio-pesticides; no significant influences of any variables except exposure to the pilot farm (EXPO), location of respondent (LOCA), gender of respondent (GEN), and commercial information source groups (IFG_COMMER) on the probability of being familiar with compost.

These findings imply that an educational level of at least primary school, distance to the pilot farms, and exposure to the pilot farms would be the key factors in increasing farmers' awareness of bio-pesticides. Gender, exposure to the pilot farms, and commercial information source groups would be the key factors to increase farmers' awareness of compost. Especially, exposure to the pilot farms would be the most important factor to increase farmers' awareness of the target organic vegetable production practices.

ACKNOWLEDGEMENT

We would like to express our appreciation to Dr. Akimi Fujimoto, who was a leader of DNBAF project at Tokyo University of Agriculture in Japan. He provided the research opportunity for this study, and financial support for fieldwork in Indonesia.

REFERENCES

Banerjee, S., Martin, S.W., Roberts, R.K., Larkin, S.L., Larson, J.A., Paxton, K.W., English, B.C., Marra, M.C and Reeves, J.M. (2008) A binary logit estimation of factors affecting adoption of GPS guidance systems by cotton producers. Journal of Agricultural and Applied Economics, 40-1, 345-355.

Cavane, E.P.A. (2007) Farmers' attitudes and adoption of improved maize varieties and chemical fertilizers in the Manica district, Mozambique. Ph.D. dissertation. Department of Community, Agriculture, Recreation and Resource Studies, Michigan State University, USA.

Dadang, A. and Ohsawa, K. (2005) The effectiveness of plant extracts in reducing cabbage insect pest population and their effect on natural enemies. Journal of International Society for Southeast Asian Agricultural Sciences, 11-3, 142-149.

Dadang, G.S., Nawangsih, A.A., Syaukat, Y. and Tjahjono, B. (2006) Development of organic rice and vegetables in the district of Bogor, West Java, Indonesia: Development of new bio-agents for alternative farming systems: 2005 Report. Academic Frontier Research Center, Tokyo University of Agriculture, Japan.

Fujimoto, A. and Miyaura, R. (1997) Farm management appraisal of Tumpang Sari vegetable cultivation in highland West Java, A one year study of farmers' practices in Cipanas. Jour. Agri. Sci., Tokyo Nogyo Daigaku, 41-4, 211-228.

Gujarati, D.N. (1995) Basic econometrics, third edition. McGraw-Hill, USA.

Hensher, D.A. and Johnson, L.W. (1981) Applied discrete choice modeling. Croom Helm, UK.

Johnson, G.I., Weinberger, K. and Wu, M.H. (2008) The vegetable industry in tropical Asia: Indonesia. Tainan, Taiwan: The World Vegetable Center.

Mundy, P.G.W. (1992) Information sources of agricultural extension specialists in Indonesia. Ph.D. dissertation. Department of Mass Communications, The University of Wisconsin, Madison, USA.

Padel, S. (2001) Conversion to organic milk production, The change process and farmers' information needs. Ph.D. dissertation. Institute of Rural Studies, University of Wales, Dyfed, UK.

Prawoto, A. and Surono, I. (2005) Organic agriculture in Indonesia, A wannabe big player in the organic world. The Organic Standard, 49, 3-6.

Rogers, E.M. (1995) Diffusion of innovations. Free Press, USA.

Sudana, M., Temaja, I.G.R.M., Miyaura, R. and Fujimoto, A. (2003) Cultural practices and economic analysis of organic and conventional vegetable farming in Bali, Indonesia. Journal of International Society for Southeast Asian Agricultural Sciences, 9-3, 104-113.

Sulaiman, R. and Hall, A. (2004) Extension policy at the national level in Asia. Paper presented at the 4th International Crop Science Congress, Australia.

Sumiartha, K., Susila, W. and Sudiarta, P. (2005) Effect of "Selasih" (*Ocimum tenuiflorum*) plant oil on fruit flies (*Bactrocera dorsalis* complex) in Long Chili. Journal of International Society for Southeast Asian Agricultural Sciences, 11-3, 46-50.

Surono, J.I. (2007) Country case study of Indonesia. Power point document presented at the Regional Conference on Organic Agriculture in Asia, Thailand.

Syaukat, Y. (2003) Factors affecting farmers in adopting low-input rice farming system in Tempuran Sub-district, Karawang, Indonesia. Journal of International Society for Southeast Asian Agricultural Sciences, 9-3, 90-103.

Syaukat, Y. (2006) Potential development of organic vegetables in Sukagalih Village, Megamendung Subdistrict, Bogor, West Java. In Development of New Bio-agents for Alternative Farming Systems: 2005 Report, 194-205. Tokyo University of Agriculture, Japan.

Zakaria, A. (2003) Decentralizing extension to local government: Indonesia experience. Paper presented at the Regional Workshop on Operational Zing Reform in Agricultural Extension in South Asia, India.

Zhou, S., Herzfeld, T., Glauben, T., Zhang, Y. and Hu, B. (2008). Factors affecting Chinese farmers' decisions to adopt a water-saving technology. Canadian Journal of Agricultural Economics 56-1, 51-61.