

Counseling Strategies Evaluation Indexes for Agricultural Business Management, Community Activities Participation, and Skills Learning of Elderly Farmers - Using Taiwan as an Example

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Abstract

This study aimed to probe into the barriers and reasons for elderly farmers' agricultural operations and participation in life activities, and to further plan related guidance policies in order to allow elderly farmers to enjoy their old age.

This study found that the obstacles for elderly farmers' agricultural operations are reflected from their inferior economic situations. Only 3% of farmers suggested that their economic situation is sufficient. Nearly 30% of elderly farmers suffered from sickness and declination; however, in order to make a living, they had to continue performing their agricultural activities. Elderly farmers who had not participated in any community activities in the past year indicated that their reasons for non-participation were "no time", "not interested" and "no idea about the activities", with "no time" having the greatest response (41.1%). Elderly farmers who had not participated in courses related to agricultural operations in the past year indicated that their reasons for non-participation were "no time", "not interested" and "no idea about the activities", with "no idea about the activities" (38%), followed by "not interested" (34.9%) and "no time" (27%). Therefore, it was necessary to probe into elderly farmers' motivation and barriers to participation.

Keywords

Agricultural Business Management; Community Activities Participation; Skills Learning

Introduction

Research Background and Motives

Rapid population aging is a general phenomenon of the national population structure. In 1993, the percentage of the elderly (above 65 years of age) in Taiwan was above the total standard (7%) set by UN. Taiwan thus has become an aging society. In October 2011, the elderly population was 10.84% (Department of Household Registration, Ministry of the Interior, 2011). In 2002, after Taiwan's entry into the World Trade Organization (WTO), agricultural liberalization significantly influenced countryside development and the competitiveness of the economy. Due to the transformation of the countryside structure, there are young population outflows and increased aging in the villages. However, according to the statistics of human resources from the Directorate-General of Budget, Accounting and Statistics of the Executive Yuan, by September 2011, the number of elderly agricultural employees had reached 91,000 (16.85% of the total number of agricultural employees). In comparison to 53,600 people in 1991 (4.9%) and 71,400 people in 1999 (9.2%), this is a significant increase, indicating that the percentage of elderly farmers is increasing in the total agricultural population. The aging of farmers in Taiwan is becoming increasingly serious year by year (Council of Agricultural, Executive Yuan, 2011).

In daily life, without proper arrangements on food, clothing, housing, transportation, education and entertainment, the elderly tend to lack independent capabilities due to physical declination and changing roles, and they often encounter difficulties due to

economic stress. This results in varied problems for the elderly. Thus, the governments of advanced countries have made an effort to establish and adjust policies for the elderly and enhance their participation in learning in order to obtain the new knowledge and skills needed to be adaptive to modern society. Governments have taken the lead in promoting successful aging of seniors. How to allow the elderly to live with confidence and dignity is an important issue.

Research Purposes

The research purposes are listed as follows:

1. Using a questionnaire to analyze the obstacles and reasons for elderly farmers' agricultural operations and participation in life activities.
2. Based on participation motivation and participation barriers, to analyze and construct concrete guidance content and strategies for elderly farmers' agricultural operations and skill learning in life activities.
3. To construct the indicators of elderly farmers' agricultural operations and skill learning for the participation in life activities.

Literature Review

Elderly Farmers

1) Meaning of Elderly Farmers

TABLE 1 CATEGORIES OF THE ELDERLY FARMERS' AGES

Scholars		Age	Category
Song (1991)		55-64 years	Early stage of the elderly
		65-74 years	
		Above 75 years	Middle stage of the elderly
			Late stage of the elderly
Cheng (1992)		60-74 years	Early and middle stages of the elderly
		75-85 years	
			Late stage of the elderly
National Cooperative Federation (2007)	Agricultural Federation	65-74 years	Early stage of the elderly
		75-84 years	
		Above 85 years	Middle stage of the elderly
			Late stage of the elderly

Source: compiled by Song (1991), Cheng (1992), National Agricultural Cooperative Federation (2007)

Most studies have suggested that being elderly is a relative concept that can be simply defined by physical age. Generally speaking, there is no standard age grouping for the elderly. Some

countries and scholars have divided the elderly into different stages and periods. In other words, different countries and scholars have defined the elderly differently (Table 1).

Elderly farmers in the villages have to continuously work hard, since they lack sufficient economic support. Many of them do not retire until they are over 70 years old and encounter health problems (Benjamin, Brandt, & Fan, 2003).

2) Effects of Activity Participation

Activity participation is an important psychological health factor for the elderly. The elderly who participate in activities more frequently are more psychologically healthy (Veenstra, 2000). By participating in activities such as volunteer work, lifelong learning and leisure activities, the elderly can construct social roles and social relationships.

Social activities for the elderly, such as volunteer work, lifelong learning and leisure activities, help the elderly to construct social roles and relationships (Bull, 2005). From the perspective of their functions, the opportunities of social roles allow seniors to have leisure activities, develop a complete view of life and reduce or avoid problems. Thus, the elderly can enjoy a positive mental state and a healthier life (Bowling, 2007; Fernandez-Ballesteros, 2008; Knight & Ricciardelli, 2003).

Research on the elderly's participation in activities has discovered the relationship among activities and health development, self-realization, self-esteem, emotional freedom, social connection and personal happiness. From the perspective of society, jobs with salaries are important; however, continuous participation in activities is also an important goal (van der Meer, 2008). In order to guide the elderly to use their free time well, it is necessary to consider the diversity of demand for activities according to personal preferences, interests and talents (Timmer & Aartsen, 2003).

Walsh and O'Shea (2008) studied the participation of senior residents in villages (in which the subjects' main occupations were agriculture and related industries) in the Third Age Foundation (TAF), which provides general activities (such as cross-generational and cross-cultural plans, dramas, health initiatives, lifelong learning, vacations and social activities) and services (such as outdoor activities, small business advice, laundry help, manicures, information seminars and technical courses). Of the subjects, 71% suggested that their satisfaction with life has been enhanced, while 62% suggested that it enhanced the self, and 52% indicated that their psychological health had improved.

Based on the above literature, activity participation not only enhances seniors' self and social connections, but also improves their physical and mental health, which positively influences their satisfaction with life and makes up for their loss of roles.

Participation Motivation

1) Literature Related to Participation Motivation

In research on the participation motivation of the elderly, Kim & Merriam (2004) suggested that there are complicated and multi-dimensional factors. The participation of seniors in learning is usually not influenced by single motive or factor. Using the scale of educational participation developed by Boshier (1991), they explored the participation motivation factors of the elderly. According to Kim & Merriam (2004), the factors of adults' participation in activities are not totally suitable for elderly learners. Therefore, two factors were eliminated in the scale of educational participation, allowing the scale to reveal a stronger prediction on seniors' learning motives. They demonstrated five factors of seniors' learning motives: cognitive interest, social contact, social stimulation, family togetherness and professional advancement, as shown below.

Cognitive interest: the participants' learning is for specific purposes, knowledge and self-satisfaction.

Social contact: the participants' learning is used to approach people and make new friends.

Social stimulation: the participants' learning is used to avoid unpleasantness, loneliness and boredom.

Family togetherness: the participants' learning is used to improve family relationships or as a measure of communication.

Professional advancement: the participants' learning is used to maintain or enhance professional positions.

.2) Demographic Variables and Participation Motivation

Demographic variables can influence the social participation motivation of the elderly. The participation factors of the elderly in learning include gender, age, educational level, health situation and economic situation.

(1) Gender

Numerous research findings have suggested that gender significantly influences the learning participation motives of adults and the elderly (Scala, 1996; Sugerman, 2003) and that female seniors have higher learning motivation. Morstain & Smart (1974) found that there are significant differences among different learning participation motivation factors. They indicated that female seniors have higher learning participation motivation because of cognitive interest. According to Boshier, Huang, Song & Song (2006), gender significantly influences the learning participation motivation of the elderly. Female seniors have higher motivation because of cognitive interest, social stimulation and social contact.

(2) Age

Young adults and early-stage elderly have higher learning participation motivation because of social factors such as social contact and social stimulation (Morstain & Smart, 1974), and early-stage elderly has higher learning participation motivation because of professional advancement (Boshier et al, 2006).

(3) Educational level

Brady & Fowler (1988) suggested that if individuals have a basic educational level, they will have higher learning motivation. According to Kim & Merriam (2004), there is a negative correlation between the elderly's educational level and social stimulation.

(4) Marital status

Marital status reveals significant and negative differences with social contact. In other words, married seniors do not have higher learning motivation for social contact (Kim & Merriam, 2004).

(5) Economic situation

Tsai & Hsu (1985) suggested that the economic problems of the elderly are due to income reductions after retirement and the rise of the living index, which lowers the purchasing power of the elderly.

Participation Barriers

1) Types of Participation Barriers

Darkenwald & Merriam (1982) suggested that situational barriers, institutional barriers,

dispositional barriers and informational barriers are the main reasons that the elderly do not participate in activities. These barriers are explained below:

- (1) Situational barriers refer to an elderly individual's difficulties in materials and environments in a certain period of time, such as expenses, time, transportation, care for children, etc.
- (2) Institutional barriers refer to the elderly absent from participation because of institutional factors, which include time arrangements, transportation, course arrangements, administrative procedures and regular time commitments. These are policies and measures from the institutions that cause the elderly to feel inconvenient, confused and frustrated.
- (3) Dispositional barriers refer to attitude or psychological barriers, as well as barriers from an individual's beliefs, values and attitude toward participation in an activity. Examples include, feeling that the age is too old participate and a lack of interest in the activities. Beliefs, values and attitudes are related to each other.
- (4) Informational barriers refer to institutions failing to provide information about activities for the elderly.

Before, during and after activities, elderly learners can encounter barriers. Learning barriers refer to personal psychological and physical factors, confidence, the families and institutes of the elderly that impede learning, resulting in difficulties and problems for participation (Huang, Lin, and Liang, 2008).

Thus, if the barriers are not overcome before the activities, the elderly might not participate. If these barriers cannot be overcome during the process, the elderly will stop the activity. Barriers after participation will influence the elderly's future participation. The recognition of the obstacles by elderly farmers in learning new skills about agricultural operations allows elderly farmers to overcome the barriers and have successful learning.

TABLE 2 PARTICIPATION BARRIERS

Darkenwald & Merriam (1982)	Situational barriers, institutional barriers, dispositional barriers, informational barriers
Huang, Lin, Liang (2008)	Effects of individual physical and psychological factors, confidence, family and learning institutes
Wang, Lin, Chen (2008)	Personal factors and school factors

Source: compiled by Darkenwald & Merriam (1982), Huang, Lin, and Liang (2008), Wang, Lin, and Chen (2008)

2) Demographic Variables and Participation Barriers

Cheng (1996) suggested that in health education activities, barriers in the aspects of physical strength, psychological and instrument for female seniors are higher than that for males. The perceived health situation, physical strength and psychological barriers reveal negative influence; while age and physical strength barriers reveal positive effects. Marital status and family type do not significantly influence the participation.

Hsieh (2001) found that demographic variables reveal differences for varying barriers. Age reveals significant differences on the lack of time, heavy family responsibilities, inferior physical strength and being busy with work. Living companions reveal significant differences on the lack of recreational information, heavy family responsibilities, the lack of spousal support, inferior physical strength and the lack of transportation. Educational level reveals significant differences on the lack of skills, heavy family responsibilities and the lack of recreational information. Total family income reveals significant differences on the lack of transportation, the lack of money, the lack of skills and the lack of opportunities to participate in activities.

In a study on elderly travel consumption, Huang and Tsai (2002) found that educational level, health situation and residential situation reveal significant differences on the travelers' barriers (inferior physical strength, not used to leaving the family, financial problems and a lack of companions).

In research on seniors' recreational participation and barriers in central Taiwan, Chen (2002) suggested that gender, different educational levels and monthly incomes (demographic variables) reveal significant differences on individual internal barriers, interpersonal barriers and structural

Scholars	Participation barriers
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barriers. Different health situations do not reveal significant differences on individual internal barriers, interpersonal barriers and structural barriers.

In research on the relationship between the perceived health situation and the recreational barriers of the elderly, Chen (2004) indicated that gender, age, marital status and current residential situation do not reveal significant differences on the overall recreational barriers. Educational level, economic situation, chronic diseases and the monthly disposable income reveal significant differences on the overall recreational barriers.

Research Method

Research Design

Using a literature review and a Delphi method questionnaire, this study first constructed the indicators of elderly farmers' participation in activities. The questionnaire was then modified upon experts' opinions, and the survey was conducted on the elderly farmers in order to probe into the obstacles and reasons of their agricultural operations and participation in life activities. The panel experts were invited from industry, government and academia, with experiences in agricultural promotion and agricultural policies, or had direct contact with the farmers.

TABLE 3 EXPERTS PARTICIPATING IN THE DELPHI METHOD

Number of The experts	Experts' background
Expert 1	Chief in charge of agricultural promotion in a farmer association
Expert 2	Worker in charge of agricultural promotion in a farmer association
Expert 3	Worker in charge of agricultural promotion in a farmer association
Expert 4	Member of the agricultural department of a local government
Expert 5	Member of the agricultural department of a local government
Expert 6	Member of the agricultural department of a local government
Expert 7	University professor with expertise in agricultural promotion
Expert 8	University professor with expertise in agricultural promotion

Source: Compiled by this study

As to the Delphi method questionnaire, by purposive sampling, the researcher selected three employees who promoted agriculture in farmer associations,

along with three officials who had implemented agriculture policies in local governments, and two professors who have taught in national universities and had agricultural promotion backgrounds, as the experts for the Delphi method questionnaire (Table 3).

The investigation was based on a literature review and the Delphi method. First of all, through a literature review, the researcher acquired nine indicators and distributed the first round of structural questionnaires for the Delphi method. The researcher invited the experts to suggest the importance of the indicators and modify or increase the indicators. However, according to the results of the returns, the experts did not suggest any modification or increase. Thus, in the second round, the questionnaire retained the nine indicators. The analytical results of the statistics in the first and second rounds were as shown above. The first and second rounds of Delphi method were compared as shown below (Table 4).

TABLE 4 COMPARISON OF THE DELPHI METHOD IN THE FIRST AND SECOND ROUNDS

Dimensions	Factors	First round		Second round	
		M1	Q.D.	M1	Q.D.
Participation motivation	Cognitive interest	3.87	0	3.87	0
	Social stimulation	4	0	4	0
	Social contact	4.12	.75	4.87	0
	Professional advancement	4.25	1	4	0
Participation barriers	Family togetherness	3.62	1	3.87	0
	Situational barriers	4.25	1	4.87	0
	Informational barriers	3.87	0	3.87	0
	Institutional barriers	4.25	1	4	0
	Dispositional barriers	3.37	1	3.87	0

Compiled by this study

Note: (1) M1= Mean; Q.D.= Quartile deviation

(2) 5 = very important, 4 =important, 3 = neutral, 2 = unimportant, 1 = very unimportant

In the first round, the indicators for participation motivation passed the convergence standard of the mean equal to the mode after rounding off and a standard deviation below 1. However, the quartile deviations for social contact, professional advancement and family togetherness were above 0.6,

which only indicates medium consistency. In addition, the indicators for the participation barriers passed the convergence standard of the mean equal to the mode after rounding off and a standard deviation below 1. However, the quartile deviations for situational barriers, institutional barriers and dispositional barriers were above 0.6, which only indicates medium consistency. Based on the above, in order to lead to more consistent expert opinions, the researcher moved the nine indicators from the first round to the second round for further testing.

Generally speaking, the means of the nine indicators in the first round ranged from 3.375 to 4.25. They were all slightly important, indicating that the experts shared a primary common consensus. The means in the second round ranged from 3.875 to 4.875, and they are all extremely important. After comparison, the researcher realized that the means of the two rounds have increased. However, since the means of the indicators were important, all of the factors were valued by the experts.

In addition, regarding the quartile deviation, the analytical result in the second round showed that six indicators were more convergent. They were more consistent than the medium and high degree of consistency between 0.00~1 shown in the first round. The quartile deviations of the second round were 0, indicating that the experts in the second round had more consistent opinions, and that the consistency was at a high degree. After the literature review and the Delphi method, the nine indicators reaching the convergence set were highly consistent. Thus, they were important indicators in guiding elderly farmers to participate in learning.

Research Subjects

Research Subjects and sampling

According to the situation of the elderly investigated by the Ministry of the Interior (2009), the elderly with an agriculture, forestry, fisheries and livestock background mostly live in central Taiwan. The top two areas with the largest area of cultivated lands are Yunlin County, at 62.61%, and Changhua County, at 59.31% (Agriculture and Food Agency, 2007). This study used Shengang Township in Changhua County, a traditional agricultural community in central Taiwan, as the research field. The percentage of the elderly population in Shengang was 10.28% at the end of September 2011. The first rice plant in 2010 summed up to 632 hectares, however, for the second, this was significantly reduced to 170 hectares (Changhua County Government, 2010); which indicates the increased level of fallow between the first and second

plantings in the Shengang area. This study randomly interviewed subjects gathered at farmer associations and in front of temples which are places farmers frequently visit in Shengang Township. There was a total of 100 valid samples.

Data Analysis and Research

Analysis of Basic Information

Using descriptive statistics on the 100 valid samples, this study probed into the distribution of the elderly farmers' demographic variables and their agricultural operations. The distribution of demographic variables included gender, age, educational level, economic situation, health situation, marital status, residential situation and current participation in community activities. Current agricultural operations included the type of cultivation, the area of cultivated land, the fallow frequency in the last three years, the participation in courses related to agricultural operations in the past year and the intention to rent out cultivated lands. The researcher analyzed the statistics of the basic characteristics of the samples, as shown in Table 5.

According to the statistics of the Council of Agriculture on elderly farmers' gender, as of September 2011, there were about 179,000 male and 68,000 females, showing that elderly male farmers are more than females. According to Table 13, the samples of this study were mostly males (80%). As to age, the elderly farmers were divided into the early, middle and late stages of old age (55-64, 65-75 and above 75 years). According to the data, there was an average distribution of these three stages; however, the early and middle stages were slightly larger than the late stage. As to educational level, most of the samples were primary school graduates. Nearly 90% failed to attend senior high school, indicating that their educational level was mostly inferior. As to their economic situation, most of the samples were sufficient money (57%), followed by slight difficulties (30%). However, about 40% of the respondents had some type of economic difficulty. Most of the respondents were healthy (71%), and most of them were married and living with their spouses (89%). As to residential situation, 95% lived with companions in contrast to the rest living alone. As to participation in community activities, half of the elderly participated in activities, otherwise the another half. The researcher interviewed the subjects using open-ended questions, as shown in Table 6. The most common response was

“no time”, following by “not interested” and “no idea about the activities”. “No time” and “no idea about the activities” were shown according to the literature

review in Chapter 2, which matched the barriers suggested by the subjects.

TABLE 5 DEMOGRAPHIC STATISTICS OF ELDERLY FARMERS

Basic information	Category	Number of people	Percentage (%)	Accumulated percentage (%)
Gender	Female	20	20	20
	Male	80	80	100
Age	55-64 years	38	38	38
	65-74 years	37	37	75
	Above 75 years	25	25	100
Educational level	Illiterate	13	13	13
	Uneducated but literate	2	2	15
	Primary school	63	63	78
	Junior high school	11	11	89
	Senior high school (vocational school)	7	7	96
	Above college and university	4	4	100
Economic situation	Wealthy	3	3	3
	Sufficient	57	57	60
	Slightly difficult	30	30	90
	Very difficult	10	10	100
Health situation	Healthy	71	71	71
	Chronic diseases	9	9	80
	Declined functions	20	20	100
Marital status	Single	11	11	11
	Married	89	89	100
Residential situation	Living alone	5	5	5
	Living only with spouse	25	25	30
	Living only with children	4	4	34
	Living with spouse and children	21	21	55
	Living with three generations	45	45	100
Participation in community activities	Yes	49	49	49
	No	51	51	100

Source: Compiled by this study

TABLE 6 REASONS FOR NOT PARTICIPATING IN COMMUNITY ACTIVITIES

Did not participate in community activities in the past year	Reasons	Number of people	Percentage (%)	Order
	No time	21	41.1	1
	Not interested	15	29.4	2
	No idea about the activities	15	29.4	2

Source: Compiled by this study

TABLE 7 ELDERLY FARMERS' CURRENT AGRICULTURAL OPERATIONS

Basic information	Category	Number of people	Percentage (%)	Accumulated percentage (%)
Type of cultivation	Rice	58	58	58
	Onion	17	17	75
	Garlic	25	25	100
Square measure of cultivated lands	Below 0.5 hectares	63	63	63
	0.5 - 1 hectare	28	28	92
	1 - 1.5 hectares	3	3	94
	1.5 - 2 hectares	5	5	99
	Above 2 hectares	1	1	100
Fallow frequency	0	58	58	58
	1-3 times	40	40	98
	More than 3 times	2	2	100
Participation in courses related to agricultural operations	Yes	37	37	37
	No	63	63	100
Intention to rent out cultivated land	Yes	18	18	18
	No	82	82	100

Compiled by this study

According to Table 7, most of the subjects grew rice (58%), most had a square measure of cultivated lands that was less than 0.5 hectares (63%), and 92% had square measure below 1 hectare. This matched the general structure of small-scale farmers and the aging of labor in Taiwan. As to the fallow frequency in the last three years, 0 times was the most common (58%), followed by 1-3 times (40%). Of the respondents, 63% had participated in courses related to agricultural operations in the past year. Of the respondents who had not participated, as shown in Table 8, the most common reason was "no idea about the activities", followed by "not interested" and "no time". "No idea about the activities" and "no time" matched the barriers suggested in past studies. Finally, 82% of the respondents did not have the intention to rent out cultivated land. Among 18 farmers (18%) who did have the intention to rent out their land, nine of them had more than 0.5 hectares of cultivated land. Of the respondents who did not have the intention to rent out their land as shown in Table 9, the most common reason was "I can still manage it", followed by "leave the land to the next generation", "I have to think about it" and "concern about careless tenants".

TABLE 8 REASONS FOR ABSENCE FROM COURSES RELATED TO AGRICULTURAL OPERATIONS

Not participating in courses related to agricultural operations in the past year	Reasons	Number of people	Percent (%)	Order
	No time	17	27	3
	Not interested	22	34.9	2
	No idea about the activities	24	38	1

Source: Compiled by this study

TABLE 9 REASONS FOR NOT RENTING OUT CULTIVATED LAND

No future intention to rent out cultivated land	Reasons	Number of people	Percentage (%)	Order
	I can still manage it	34	41.5	1
	Leave the land to the next generation	21	25.6	2
	Concern about careless tenants	13	15.9	4
	I have to think about it	14	17	3

Source: Compiled by this study.

Correlation Analysis

According to the literature review in Chapter 2, the elderly farmers' participation motivations are external

stimulation or the realization of internal goals. Thus, their participation is not only based on a single motivation. Elderly farmers might join in activities due to their interests or an intention to enrich their lives. They might also intend to make new friends or spend a pleasant time with their friends. By participating in activities, they will not be alone or feel bored. They also participate in activities for social stimulation, which benefits their daily lives. In addition, elderly farmers might have the intention to participate in order to cultivate interest with the family or enhance their expertise.

During participation, elderly farmers often encounter barriers that can lower their desire or satisfaction. Due to difficulties in materials or environments, elderly farmers could encounter situational barriers. Institutional barriers could also limit their participation. Elderly farmers' attitudes and psychological factors could result in dispositional barriers. There are also informational barriers caused by the institutions inefficient in the delivery of information to the participants. Based on the above, the barriers elderly farmers confronted in participation of activities include situational barriers, institutional barriers, dispositional barriers and informational barriers.

According to the results of the data analysis, there was a significantly negative correlation between participation motivation and participation barriers, as shown in Table 10; which indicated that elderly farmers with higher participation motivation would encounter lower participation barriers.

TABLE 10 CORRELATION BETWEEN PARTICIPATION MOTIVATION AND PARTICIPATION BARRIERS

	Participation motivation	Participation barriers
Participation motivation	1	-.303**
Participation barriers	-.303**	1

Source: Compiled by this study.

Note: **P<.01

One-way ANOVA

By means of one-way ANOVA, this study attempted to find if the elderly farmers' demographic variables revealed significant differences for participation motivation and participation barriers. When a significant difference was found, it was analysed using the Scheffe method in Post-hoc analysis.

1) Participation Motivation

Gender will influence cognitive interest and social stimulation. Female elderly farmers, in comparison to the male counterpart, have higher cognitive interest and social stimulation. Age will influence social stimulation, social contact and professional advancement. Late-stage elderly farmers, in comparison to those in the early stage, have lower social stimulation, social contact and professional advancement. Economic situations will influence professional advancement. Elderly farmers with economic difficulties, in comparison to those who are wealthy or have sufficient money, have lower professional advancement. Marital status will influence cognitive interest, social contact and family togetherness. In comparison to married elderly farmers, single ones have lower cognitive interest, social contact and family togetherness.

2) Participation Barriers

Gender will influence dispositional barriers. The dispositional barriers of female elderly farmers are higher than those of males. Age will influence dispositional barriers. The dispositional barriers of late-stage elderly farmers are higher than those of the early stage. Economic situations will influence situational barriers. The situational barriers of elderly farmers with difficult economic situations are higher than those of farmers with sufficient money. Marital status will influence informational barriers, institutional barriers and dispositional barriers. The informational barriers, institutional barriers and dispositional barriers of single elderly farmers are higher than those of married elderly farmers. Health situations will influence situational barriers and dispositional barriers. The situational and dispositional barriers of elderly farmers with chronic diseases are higher than those of healthy elderly farmers. Residential situations will influence informational barriers. The informational barriers of elderly farmers who only live with their spouses are higher than those who are living with three generations.

Conclusions and Suggestions

Elderly farmers are part of the minority in society. They are approaching the retirement; however, they need to remain hardworking. How to enhance the participation of elderly farmers in activities in order to lead to successful and healthy aging is an important social issue. Therefore, it is necessary to recognize the

motivations of elderly farmers.

In addition to the motivation, it is also important to probe into their barriers. Through a literature review, according to data statistics and analysis, and after the study, the researcher acquired the following conclusions.

Obstacles and Reasons for Elderly Farmers' Agricultural Operations and Participation in Life Activities

1) Agricultural Operations

The obstacles of elderly farmers in agricultural operation were demonstrated by their inferior economic situations. Only 3% of the respondents suggested that they had sufficient money to support themselves. Low incomes and prices of agricultural products are related. The elderly farmers mostly suggested that their income from agriculture was nearly equal to the cost of agriculture, resulting in little profit.

Although 71% of the elderly farmers were healthy, they were encountering physical declination. Of the respondents, 30% suffered from sickness and declination. However, in order to make a living, they had to continue working.

2) Participation in Life Activities and Courses Related to Agricultural Operations

The reasons for the elderly farmers who had not participated in community activities in the past year included "no time", "not interested" and "no idea about the activities", of which "no time" was the most common response (41.1%). Due to being busy with agriculture, they did not have the intention to participate in activities. "Not interested" and "no idea about the activities" were given as reasons by 29.4% of the respondents. The reasons of the elderly farmers who had not participated in courses related to agricultural operations in the past year included "no time", "not interested" and "no idea about the activities". Of the responses, "no idea about the activities" was the most common (38%), followed by "not interested" (34.9%). The least common reason was "no time" (27%). Therefore, it was necessary to probe into the motivation for elderly farmers' participation and their participation barriers.

Content and Strategy of Guidance

Regarding the effects of the barriers and different

demographic variables on the motivations, the responsive guidance content and strategy was suggested below.

1) Simple and Multiple Activities:

Elderly farmers' intention can be easily influenced by dispositional barriers and situational barriers. They will question their capabilities and might consider the activities meaningless. The host institutions can simplify the content so that the elderly farmers' intention will not be reduced. Multiple activity themes can attract different types of elderly farmers. For instance, learning new knowledge in life can attract more female elderly farmers, and learning new agricultural techniques can attract more early-stage elderly farmers. The activities can be flexible, and the farmers' learning effectiveness and participation can be enhanced through discussions and by posing questions.

2) Reward for Renting Out the Cultivated Lands:

Due to limited time and agricultural works, elderly farmers have low intention to rent out their cultivated land. Elderly farmers' agricultural income does not match their time and effort spent in farming. According to their intention to rent out cultivated land, the reasons for their lack of intention are "I can still manage it", "leave the lands to later generation", "concern about the careless tenants" and "I have to think about it". This means that elderly farmers mostly intend to keep working and do not have a sense of security regarding renting out cultivated lands. This study suggests that rewards can be offered for renting out the land. Thus, elderly farmers will not have to worry about their lives, and their intention to rent out the land will be enhanced. A land guarantee system can be developed to ensure that the farmers' lands will not be destroyed or illegally occupied by the tenants, and that the lands will still be inherited by later generations.

3) Network of Information

The participation of elderly farmers can be influenced by informational barriers, which deprives them of understanding the activity or even idea about its existence. The host institutions can develop a network of information. Based on the neighborhood, they can first distribute information to the heads of the districts or neighborhoods who can then pass it to the farmers. They can also post the information in places where elderly farmers

often go, such as local religious centers and farmer associations. This study suggests that the elderly farmers' intention will be enhanced by familiar channels and the invitation from the relatives and friends.

Guidance Indicators

A literature review and two rounds of the Delphi method provided the following results:

1) Indicators of Participation Motivation

The indicators of participation motivation include perceived interest, social encouragement social contact, professional advancement and family togetherness.

2) Indicators of Participation Barriers

The indicators of participation barriers cover barriers in situational, informational, institutional and dispositional.

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Dissipation and Persistence of Thiodicarb in Cotton

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Abstract

Field study was carried out to investigate persistence and dissipation kinetics of thiodicarb (Larvin 75 WP) applied at the time of flower initiation stage of cotton crop (H-1117) @ 500 (T1) and 1000 g a.i.ha⁻¹ (T2) during kharif season. The dissipation was 100% in soil at both the doses after 35 days of application following a first order kinetics. The half life value was observed to be 7.27 days in T1 and 7.81 days in T2, respectively.

Keywords

Thiodicarb; Half- Life; Dissipation; First Order Kinetic; Residue

Introduction

Cotton, 'The King of Fibers and a crop of prosperity' having a great impact on men and matter, is an industrial commodity worldwide importance. It is one of the most important cash crops of India, grown over an area of about 88.2 lakh hectare, with a production of 242.50 lakh bales and productivity of 467 kg ha⁻¹ (Anonymous, 2007). It is grown under diverse agroecological conditions in North, Central and South zones. Unfortunately, cotton is damaged by multitude of insectpests and diseases that pose a serious threat in arresting high cotton production in India. Crop losses in cotton have been reported due to several pests chiefly including *Earias vittella* (30- 40%), *Pectinophora gossypiella* (20-95%) [Panwar, 1995] and *Helicoverpa armigera* (20-80%) [Monga and Jeyakumar, 2002]. Several potent pesticides have been recommended to eliminate these pests on this crop which consumes around 50% of pesticides in India (Singh *et al.*, 2004) and accounts for 40% of the total production cost and ranks first in terms of pesticide consumption (Dudani and Sengupta, 1992). But the pesticide use pattern in the present day situations has led to resistance build up by pests and pesticide residues, which demands

newer and safer pesticides with different modes of action.

Thiodicarb, [3,7,9,13-tetramethyl-5,11-dioxo-2,8,14-trithia-4,7,9,12-tetraazapenta deca-3,12- diene-6,10-dione] is non systemic oxime carbamate which acts as insecticide and ovicide with both oral and contact activities against major *Lepidoptera*, *Coleoptera*, *Diptera* and *Hemiptera* pests on cotton, maize, fruits, soybean and vegetables (Fig. 1). It is a neurotoxic compound that acts by inhibiting acetyl cholinesterase activity. Thiodicarb is commonly used as seed treatment, due to its translocation through the plant (Tomlin, 2003)

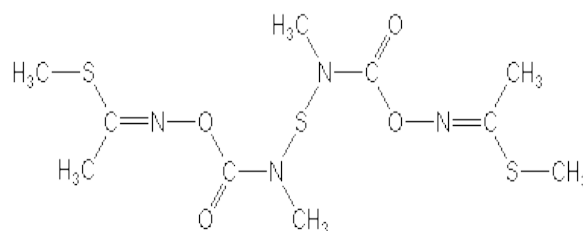


FIG. 1 STRUCTURE OF THIODICARB

As very scanty work has been carried out to know the behaviour of thiodicarb on cotton under Indian conditions, so the present studies were carried out to generate information about persistence and degradation behaviour of thiodicarb on soil, cotton seed and lint.

Material and Methods

A field experiment was conducted on sandy loam soil (EC 2 dSm⁻¹; K_c 10.08, P₂O₅ 15 kg ha⁻¹) having pH 7.6 and organic carbon 0.67% at Research Farm of the Department of Plant Breeding, CCS HAU, Hisar using randomized block design (RBD) with a plot size of 25 m² on which cotton (*Gossypium hirsutum*) variety H-

1117 was raised during *Kharif* season. Thiodicarb (Larvin 75 WP) was applied in the field at the time of flower initiation stage at two different doses. The treatment T₁ was 500 g a.i.ha⁻¹ and T₂ consisted of 1000 g a.i.ha⁻¹ and a control where no pesticide was applied. Samples of soil under the cover of cotton crop were collected periodically from top 15 cm of soil profile on 0 (1h after treatment), 7, 14, 21, 28, 35 and 42 days after spray and cotton lint and seeds were collected at the time of harvest. The samples were processed as per method of Anonymous (1978).

Well ground, sieved and representative soil sample (20 g) was shaken vigorously on mechanical shaker for 1.5 hour after adding 100 ml solution of 1:1v/v acetone: water. The extract was then filtered through Whatman's paper no. 1 and transferred to separatory funnel after that diluted with 10% sodium chloride solution and partitioned thrice with dichloromethane (75, 50,25ml) by vigorous shaking. The extract was concentrated to near dryness and the volume made up to 2 ml with n-hexane and analyzed by GC.

To the representative 5 g cotton lint, 10 g each cotton seed and seed cake, 200 ml acetonitrile was added and extracted on Soxhlet apparatus for 8 h. The extract was then filtered, transferred in separatory funnel and diluted it with 10% sodium chloride solution. The extract was partitioned twice with hexane (100,100 ml) followed by partitioning twice with dichloromethane (100,100 ml) by vigorous shaking. The organic phases were combined and then concentrated to about 5 ml on a rotary vacuum evaporator at 50-55°C. For clean-up, glass column (60 cmx22 mm i.d) was packed compactly with silica gel in between two layers of anhydrous sodium sulphate. The column was prewetted with hexane firstly and then the concentrated extract was loaded in the column which was eluted with a solution of dichloromethane: acetone(1:1v/v). The cleaned extract was evaporated to dryness and finally dissolved in 2 ml n-hexane for analysis by GC.

Residues of thiodicarb were determined on Shimadzu 2010 equipped nitrogen phosphorous detector and HP-1 capillary column (30 m x 0.32 mm i.d. x 0.25 µm film thickness). Other GC parameters were as follows: Temperature (°C): Oven: 100 (1 min) →10°min⁻¹ →200 (0 min) →20°min⁻¹ →260°(3 min). Injection port: 250; detector: 275. Carrier gas (N₂) flow was 1.8 ml min⁻¹. Retention time (Rt) for thiodicarb was 1.655 min.

Result and Discussion

TABLE 1 RESIDUES (MGKG⁻¹) OF THIODICARB IN SOIL

Days after treatment	Residue (mg kg ⁻¹)			
	T ₁ (500g a.i. ha ⁻¹)		T ₂ (1000g a.i. ha ⁻¹)	
	Average Residues	% Dissipation	Average Residues	% Dissipation
0	0.015	-	0.027	-
7	0.007	53.33	0.013	51.85
14	0.004	73.33	0.008	70.37
21	0.002	86.66	0.004	85.18
28	BDL	100	BDL	100
35	-	-	-	-
42	-	-	-	-
Harvest	-	-	-	-
Rate constant k (days ⁻¹) = 0.09532		Rate constant k (days ⁻¹) = 0.08873		
Correlation Coefficient r = -0.9991		Correlation Coefficient r = -0.9972		
Regression Equation = 1.1640-0.04137x		Regression Equation = 1.4173-0.03855x		
t _{1/2} = 7.27 d		t _{1/2} = 7.81 d		

C.D. (P=0.05) for days=0.002, for dose=0.001, for days x for dose = 0.003 ; BDL: 0.002 mg kg⁻¹

Average recoveries of thiodicarb from samples of soil fortified at 0.25 and 0.50 mg kg⁻¹ levels were 96.13 and 93.14 per cent, respectively whereas those from cotton lint fortified at 0.50 and 1.0 mg kg⁻¹ levels were 85.63 and 82.11 per cent, respectively and those from cotton seed oil fortified at 0.50 and 1.0 mg kg⁻¹ levels were 83.65 and 79.01 per cent, respectively while that of seeds were 82.41 and 80.11, respectively.

As evident from Table 1, thiodicarb when applied @ 500 g a.i. ha⁻¹(T₁) had average initial deposits of 0.015 mg kg⁻¹ on 0 day (1 h after treatment) which dissipated to 98.66 per cent leaving 0.0002 mg kg⁻¹ residues after 28 days of the treatment. While at T₂ (1000 g a.i. ha⁻¹), the initial residues of 0.027 mg kg⁻¹ on 0 (1 h after treatment) day dissipated to 0.0006 mg kg⁻¹ residues in the soil after 28 days of the treatment showing percent dissipation of 97.77. The residues decreased significantly with increase of time duration, were below detectable level at both T₁ and T₂ after 35 days

of the spray showing that the residues were dissipated completely (100%) at the applied doses. The persistence toxicity of thiodicarb was found to be 587.9 hours i.e. 24.49 days when used at recommended dose by Dhawan et al (2009). Brevault et al (2009) used thiodicarb @ 750 g a.i. ha⁻¹ in cotton field and reported that the insecticide persisted for 27.0 days in the absence of rain but rainfall had negative effect on persistence of thiodicarb which got reduced to 17.3 days. The dissipation of thiodicarb residues in soil followed first order kinetics (Fig. 2). Half-life of thiodicarb applied @ 500 g a.i. ha⁻¹(T₁) was found to be 7.27 days and 7.81 days when applied @ 1000 g a.i. ha⁻¹(T₂). In the studies carried

TABLE 2 RESIDUES (MG KG⁻¹)OF THIODICARB IN COTTON LINT, SEED, OIL AND CAKE

Commodity	T ₁ (500 g a.i. ha ⁻¹)	T ₂ (1000 g a.i. ha ⁻¹)
Cotton Lint	0.226	0.451
Cotton seed	0.169	0.227
Seed oil	0.013	0.020
Seed Cake	BDL	0.010

BDL: Below detectable Level; MRL: 0.5mg/kg for cotton seed; 0.02mg/kg for seed oil

out to know the movement of thiodicarb in surface soils by Jones et al (1989), the half life of the insecticide was found to be few hours only. Statistically analyzed data showed that the interaction between days and treatment was found to be significant with the value of 0.003 and critical difference ($p= 0.005$) for treatments was found to be 0.001 while for days it was 0.002. The residues from 21 days onward after treatment were at par. Higher dose showed significantly more residues as compared to lower dose ($CD=0.002$; $p\leq 0.05$). As evident from Table 2, residues of thiodicarb in lint at harvest were detected to a level of 0.226 and 0.451 mg kg⁻¹ in T₁ and T₂ treatments, respectively. Several factors affect insecticide persistence on crop produce, but the most important is prevailing weather conditions during and after application (Mulrooney and Elmore, 2000). Due to non- availability of MRL values in lint, safety level of thiodicarb could not be assessed. In cotton seed, the residues at harvest were below MRL value of 0.02 mg kg⁻¹ whereas in cottonseed oil, residues of thiodicarb at harvest remained below MRL value of 0.02 mg kg⁻¹ in both treatments. In seed cake at harvest, no residues were

detected in T₁ treatment while residues to a level of 0.010 mg kg⁻¹ were detected in T₂ treatment.

Conclusion

The residues of thiodicarb were below detectable level in soil at the time of harvest thus indicating 100 percent dissipation. Therefore, thiodicarb at the tested doses i.e. 500 g a.i. ha⁻¹ and 1000 g a.i. ha⁻¹ in soil system can be considered safe from the point view of hazards due to its residues.

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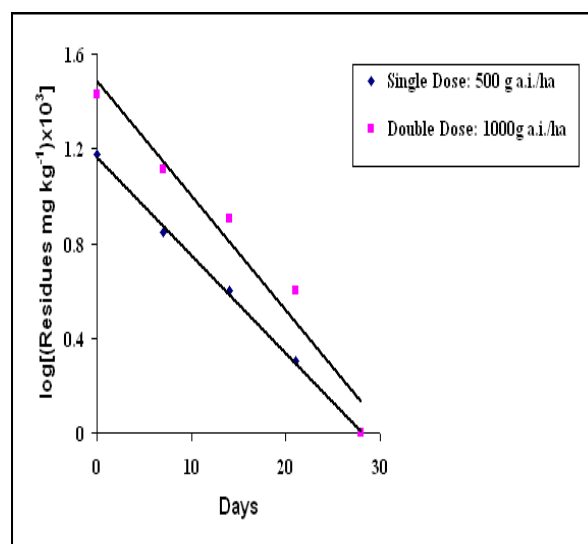


FIG 2 DISSIPATION KINETICS OF THIODICARBRESIDUES IN SOIL

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