Comparative Analysis of the Safe Training Performance about Farmers Use Pesticide -Sichuan Province of China as an example

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Abstract

The Ministry of Agriculture of People's Republic of China put in practice in non-hazardous food production and high-toxicity pesticides elimination, which aim at human, food and environmental safety. To investigate 491 farmers in Sichuan Province, the paper analyzes comparatively training content, fixed-point samples, different areas and training influence. The training content focuses on pesticide purchase, label reading, personal protection, container disposal, sprayer maintenance and sprayer cleaning. The results of SPSS statistical software show that there is a significant difference in 30 fixed-point samples between before and after training, and each index has obvious performance. And the results of component score and comprehensive scores of different areas show that part of areas'

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performance are obvious. Finally, the policy recommendations are suggested aiming at the actual situation.

JEL code: Q16

Key Words: Training performance; Farmers; Pesticide

1. Introduction

With improving the standard of living，consumers start to care more about "quality" than "quantity" of agricultural products. The majority of Chinese farmers lack necessary knowledge on pesticide use because of their low educational levels. It leads to high pesticide residue in agricultural products and the environmental pollution, which became main obstacle in entering domestic and international markets for China. The safety in pesticide application and sprayer maintenance was another key that was neglected by farmers; this was the main reason for occupational and accidental poisonings. Meanwhile, environmental pollution due to the un-appropriate disposal of pesticide package was the hidden threat for rural environment. The effective and safe use of pesticide became important as it was the vital material for agricultural production in China to control crop disease, insect, weed and rat. Farmers are the users of pesticide, but also the direct beneficiaries or victims. Therefore, it is very important to strengthen safe use of pesticide training for farmers, control pesticide residual contamination from the source, strive to the safe use of pesticides management in agricultural production, and achieve overall monitoring from field to table.

As for the research on safe use of pesticide training, there were many recommendations for pesticide applicator training (Kent, JH Pratley 1987; Panter 1994) in a lot of country: UK

(A.E. Watterson, H.F. Thomas, 1992); USA (Ozkan 1999; Thomas A Arcury, Sara A Quandt, Colin K Austin, John Preisser, Luis F Cabrera 1999); Australia (Hewitt 2006). Pesticide safety training for tropical smallholders (Whitaker 1993) and among farmers from Mexico(Arcury, TA Quandt, SA Rao, P. Russell 2001), Starr County Texas (Shipp, EM Cooper, SP Junco, DJ Bolin, JN Whitworth, RE Cooper 2007), Punjab and Pakistan （Muhammad Aslam Tanvir Ali Zafar 2007）.Training reduced pesticide report card (Ag at Large Don Curlee 2005;).When as to the training content, South African farm workers' interpretation of risk assessment data expressed as pictograms on pesticide labels (Hanna-Andrea Rother 2008); assessing farmers' practices on disposal of pesticide waste after use(Christos A. Damalas, a, , Georgios K. Telidisa and Stavros D. Thanosa 2008).More studies involved IPM field-school training (e.g. George F Czapar, Marc P Curry, John E Lloyd 1998; Marcia J Ishii-Eiteman, Nila Ardhianie,2002; Elizabeth J. Z. Robinson, Sumona Rani Das and Tim B. C. Chancellor,2007).Donald J. Ecobichon (2001) studied pesticide use in developing countries. In China, most literature introduced practical technology and experience from the natural science. If the researches belong to the humanities and social sciences, they were only training records, such as research on training system of pesticide application technique in China (Zhao and Zheng 2003), Study on the current situation, reasons and countermeasures of pesticide use in China (Liu 2005). Few studies had been conducted to training performance. They used qualitative analysis methods even more, and only analyzed after training. A handful of scholars used econometric methods, such as Gu and Zhu (2001) studied the prevention and treatment of pesticide poisoning with RSR

evaluation. The perennial occurrence of crop disease, insect, weed and rat is11,000 million mu[a] in Sichuan province of China, and the prevention and treatment is more than 13,000 million mu (Gao 2005). In this article, based on investigating 491 farmers of 23 villages and towns in Sichuan Province of China, we analyze comparatively training performance between before and after training, and utilize factor analysis method to study the difference areas.

2. Comparative Analysis of training content

2.1 Data source

The safe use of pesticide training performance questionnaire is randomly surveyed by on-site training, field inquiry, field observation and seminars. The trained people include random farmers, demonstration farmers, pesticide retailers, and agricultural techniques extension personnel. All 23 trained towns are covered. The total number of the questionnaire is 500 and 491 in effect. The research includes six sections: pesticide purchase, label reading, personal protection, container disposal, sprayer maintenance and sprayer cleaning. About 6% is the same person before and after training for the investigation. The fixed-point sample size is 30 people.

2.2 Training content

2.2.1 Pesticide purchase

The study show that the rate of pesticide selection by the advice of retailers decreased from 38.91% (before training) to 26.57% (after training), the rate of extension personnel increases from 46.84% to 64.86%, increasing 18.02%. The result shows that the extension department has more influence on farmer's choice. The extension department plays an

[a] 15 mu=1hectare

important role in leading farmers to select appropriate pesticides which are low residue, low toxic and environmental friendly.

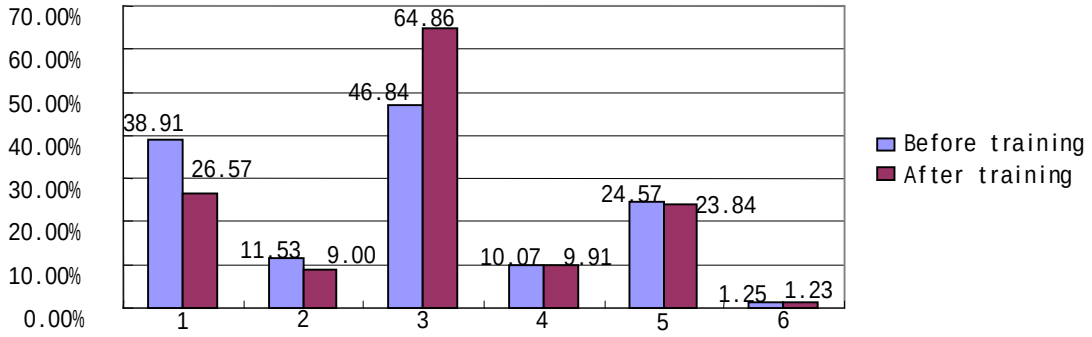

Fig.1 Pesticide Purchase

Note: 1.Recommended by retailers 2.Recommended by other farmers 3.Recommended by extension department 4.Advertisements 5. Own decision 6.others

2.2.2 Label reading

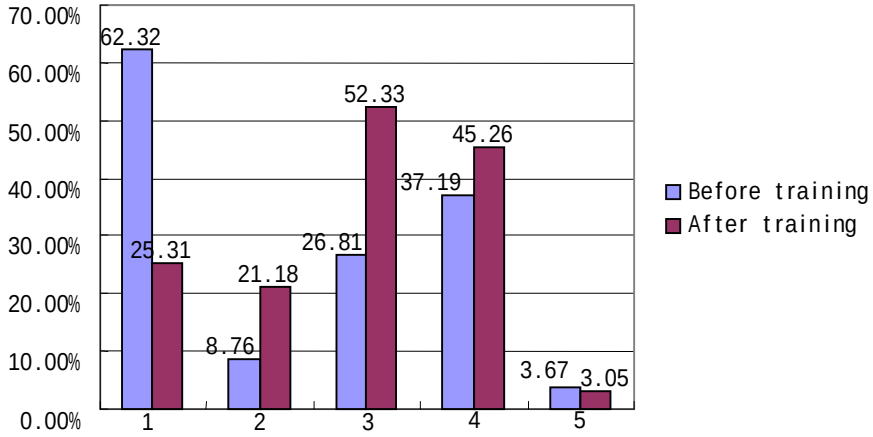

Fig. 2 Label Reading

Note: 1.Understanding PHI 2.Read label before application 3.Understanding the there certificates numbers of pesticide 4.Yes 5.Do not understand the label 6.Use PPE in key part of body

96.95% farmers know PHI after training, 23.58% higher than before. The better control over the application time helps farmers use pesticide more effectively and decreased pesticide in agricultural products. 96.59% farmers read label before application, 12.53% more than before. The farmers get pesticide information on toxicity; target crops, pest spectrum, use rate, application timing, and etc. 96.74% farmers know the meaning of three certificates of pesticide (pesticide license, pesticide standard, and pesticide registration), 31.73% higher than

before. 96.63% farmers understand safe requirements and follow the instruction of label, increasing 16.84%. The use of the PPE in key part of body increases 14.53% in comparison.

2.2.3 Personal protection

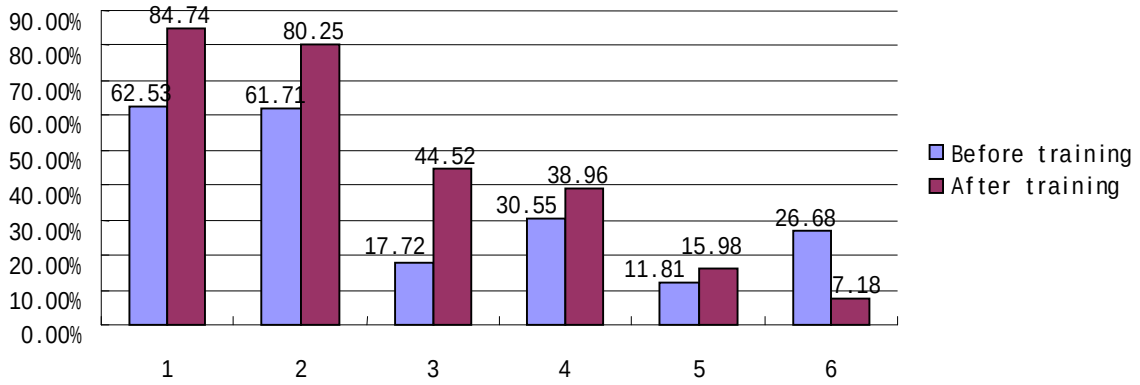

Fig. 3 Personal protection

Note: 1.Long sleeve shirt 2.Long trousers 3.Gloves 4.Shoes and boots 5.Others (e.g. raincoat)
6. Pay no attention, dress as usual

Skin contamination is the most general cause of occupational poisoning. The farmers taking personal protection measures while mixing and loading rise dramatically in comparison with before. The use of long sleeve shirt, long trousers and gloves reaches 44.52%, 84.74% and 80.25%, 26.80%, 22.21% and 18.54% more than before respectively. The influenced farmers also use raincoat as protective equipment when spraying. Fewer farmers don't care about PPE; the rate is decreased 19.50%, to 7.18%. The consciousness and behavior of personal protection increase after training.

2.2.4 Container disposal

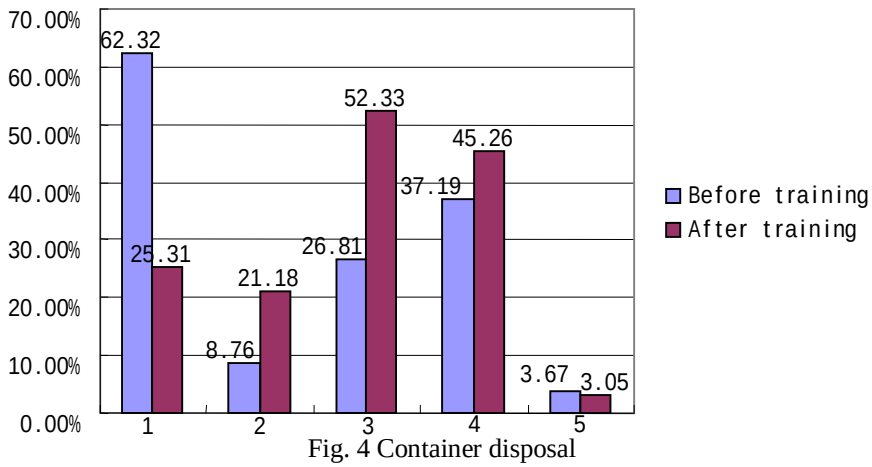

Fig. 4 Container disposal

Note: 1. Throw away in the field 2.Bury 3.Burn
4. Put into plastics bag and take away from field for disposal

More farmers follow the correct measure of container disposal after training and fewer farmers dispose the container at will (decreasing 37.01%). 45.26% farmers gather the container in plastic bag and took away from field for correct disposal. Meanwhile, 25.31%farmers still throw empty package in the field and 52.33% farmers think it is right to burn the package; this may lead to environmental contamination by these behaviors.

2.2.5 Sprayer maintenance

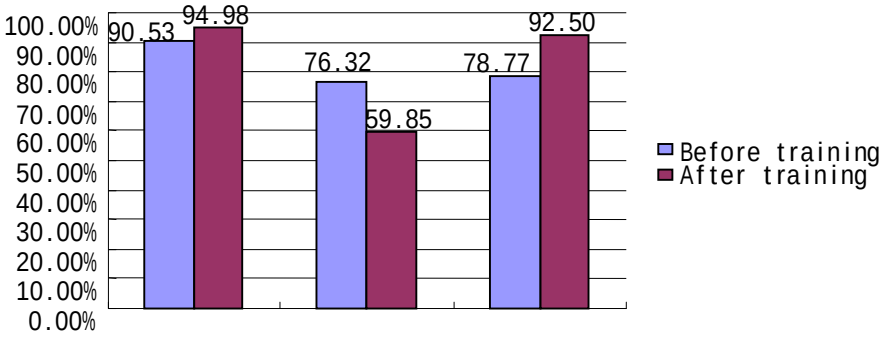

Fig.5 Sprayer maintenance

Most farmers cheek the sprayer before spray to avoid leakage, while they don't take immediate to maintain it. 92.50%farmers maintain the sprayer timely after training, increasing13.73%.The sprayer leakage decreases to 59.85%, 16.47%less than before. The training helps farmers understand the importance of sprayer maintenance and more farmers often check their sprayer to avoid leakage. However, the leakage of sprayer still can be found in the survey and the rate was still high.

2.2.6 Sprayer cleaning

Through training, 92.10%farmers clean their sprayer timely after pesticide application, increasing 11.04%.Farmers spill waste into the water canal decreased 17.39% and 7.64% farmers spilled it into field. The rate of spilling waste near well is decreased 0.13%. The

behavior will help reduce the environmental pollution caused by pesticide.

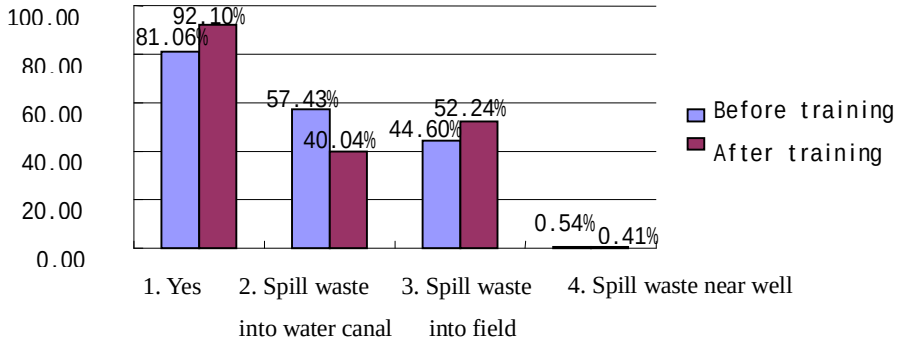

Fig.6 Sprayer leaning

3. Comparative analysis of fixed-point samples

The independent observation results of 30 fixed-point sample are (X_1, Y_1), (X_2, Y_2), ……, （X_{30}, Y_{30}）, so make: D_1= X_1-Y_1, ……, D_{30}= X_{30}-$Y_{30,}$while D was normal distribution, denoted by N(μ_D, σ_D^2). Establish the following hypothesis: H_0: μ_D = 0, it has no significant influence on raising farmers safe use of pesticide by training; H_1: μ_D <0, it is. Through SPSS statistical software, the correlation is 0.951. There is a strong correlation between paired samples, and the linear relationship is better between before and after training performance.

Table 1 Paired differences test

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Before and after training	-1.62173E1	7.14515	1.30452	-18.88538	-13.54929	-12.432	29	.000

When the significant probability is less than 5%, the differences is significant between paired-sample. In Table 1, significant probability is 0, so it refuses H_0. The result is significant differences between before and after training. So if farmers have been trained safe use of pesticide, there will have a significant influence, and vice versa.

4. Comparative analysis of different areas

The research divides 23 training towns of Sichuan (in Table 2) and will utilize factor analysis method to study the different training performance.

Table 2 Eight areas of 23 training towns

Area	Town	Area	Town
1	Xiwai, Nanxing, Sanxing, Xinping	5	Songlin, Lianshan, Shuangquan
2	Xingfeng, Guangxing, Xiangyang	6	Jinyu, Hexing, Xiaohan
3	Dongnan, Sanshui ,Wangfu, Beiwai	7	Xinhua
4	Nanfeng, Xinglong, Jinlun, Gaoping	8	Xigao

Through SPSS, we use factor analysis method to study 6 indicators (X_1=pesticide selection, X_2=label reading, X_3=personal protection, X_4container disposal, X_5=sprayer maintenance and X_6=cleaning): the standardization of raw data; correlation matrix R; the calculation of eigenvalue λk, the variance proportion bk, cumulative variance proportion Σbk and corresponding eigenvector (αki); according to Σbk> 80% (in accordance with the general principle that the cumulative variance proportion is more than 80%); Extraction of principal component K (k = 1,2, ..., K); the linear combination (ykj) of the k principal component and the standardization of 6 index data; calculation of the comprehensive score.

4.1 KMO and Bartlett's test of Sphericity

By calculating KMO and Bartlett's test of Sphericity, KMO was 0.625> 0.6, so the data is suitable for factor analysis. In Bartlett's test, P = 0.042> 0.05, independence hypothesis of variables is not tenable. The applicability of factor analysis is passed by test.

4.2 Eigenvalues calculation

Now, there is R, λk, bk, Σbk in Table 3, it shows the variance proportion of first two factors is 82.40%. So the factors are adequate to describe the overall training performance.

Through extracting the two as principal component, commonality can be calculated. The variance proportion of principal component is quite high, and it is certain to explain variables. Therefore, the result of factor analysis is effective.

Table 3 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.855	64.245	64.245	3.855	64.245	64.245
2	1.089	18.156	82.402	1.089	18.156	82.402
3	0.719	11.991	94.393			
4	0.219	3.654	98.047			
5	0.073	1.223	99.270			
6	0.044	0.730	100.000			

4.3 Factor rotation

In Table 4, the first principal component has a greater load in addition to X_4 (container disposal). We define the first principal component as comprehensive training factor of safe use of pesticide. The second principal component has a lot of load in X_4, and it reflects in the position and role of pesticide packaging in the safe training. So it is defined as the influence factor of container disposal. The character and order of two factors are better to embody the safe use of pesticide training‘s significance. For a long time, people pay attention to deal with pesticide packaging, but the problem is still with us.

Table 4 Rotated component matrix

Component	Pesticide selection	Label reading	Personal protection	Container disposal	Sprayer maintenance	Sprayer cleaning
1	0.787	0.815	0.832	0.047	0.577	0.896
2	-0.101	0.314	0.360	0.982	0.727	0.316

In the absence of proper recycling pesticide packaging method, now farmers throw prevalently pesticide empty bottles or packaging everywhere. They pollute seriously water,

soil and air, and cause environmental degradation of agricultural production area. That not only affects the quality safety of agricultural products, but also harms people health. So in the safe use pesticide training, the container disposal training has always been a weakness that affects the training performance.

4.4. Comparative analysis of different areas

In order to study the training performance of different areas and evaluate comprehensively, we list principal component functions by coefficient matrix. The two principal components denoted linear forms of 6 indexes. The principal component functions are: F1=0.373X1+0.264X2+0.258X3-0.266X4+0.039X5+0.299X6

F2=-0.304X1-0.005X2+0.024X3+0.714X4+0.371X5-0.027X6

The scores of F1and F2 reflect the different areas' training performance, but one principal component alone can't make comprehensive evaluation of the entire training program. So we must calculate the comprehensive statistics (F) by the variance proportion of each principal component. We calculate the component scores, comprehensive scores and the areas order. F=0.779762F1+0.220238F2

Table 5 Component score and comprehensive scores

Area	Fac1_1	Fac2_1	Comprehensive scores	Order
1	0.44046	0.19212	0.385766	2
2	-0.42146	0.5541	-0.2066	8
3	-0.14333	1.98186	0.324718	3
4	0.67767	-0.9454	0.320208	4
5	1.87064	-0.2084	1.412756	1
6	-0.48542	1.03544	-0.15047	7
7	-0.10444	1.22948	0.18934	5
8	0.33434	-0.98629	0.043487	6

From Table 5, the fifth area (Songlin, Lianshan, and Shuangquan) scores the highest for

1.412756. The fifth area is abundant in natural resources and products, e.g. Songlin town develop rural tourism by its peach blossom mountain; Lianshan town has a famous dish named Huiguo meat; Shuangquan town has a delicious and rare kind of fish named Zhenxi fish. The three towns have their focus of economic development respectively. So it is a prosperity area with convenient transportation and communication facilities, and water, roads and other infrastructure are getting better. The economic development brings along higher quality of farmers in fifth area. The consciousness and behavior of safe use of pesticide is better than other areas. In particular, Songling town had won the "high-quality fruit base in Deyang City," "fruit of professional town in Deyang City," "Deyang City medicine base ", , "pollution-free vegetable base in Sichuan province," "pollution-free agricultural production base in Sichuan province," and so on. “Songling grapefruit” and “Songling peach” were awarded pollution-free agricultural products certificates of Chinese Ministry of Agriculture, and “Songling” is a fruit trademark. Because of strict implementation of national standards for pollution-free agricultural production, it makes basic conditions of farmers in the fifth area are better. All of this affects training performance of fifth area is the most obvious after training. The second area (Xingfeng, Guangxing, and Xiangyang) is the last. The three towns lack characteristics products, and agricultural and economic base is weak relatively. The consciousness of farmers using pesticide safely and scientifically is not strong. Some comprehensive scores are negative in Table 5, but negative does not mean adverse performance. Their true meaning is the relative status of 8 areas, and they are under the average level.

5. Comparative analysis of training influence

The trained key farmers, retailers and local extension workers have different influence on other farmers. The retailers have the high influence on the farmers as they have shops and can spread the knowledge of safe use when farmers come to buy pesticide. According to the research, the retailers can influence 8.64% farmers of their nearby areas. The extension workers, however, have the higher influence in comparison with retailers. They are responsible for a wider range than retailers, and they are more reliable to farmers. In average, each extension worker can influence 262.83 farmers, 12.63% more than retailers. Now there is an effective network of key farmers, retailers and extension workers in safe use knowledge extension.

Table 6 Comparative analysis of training influence Unit：person, %

Trained Targets	Number	Influenced farmers (each)	Influenced farmers (total)	The population of surveyed town	% of the influenced farmers
Key farmers	35	36.6	1281	121941	10.51
Retailers	75	199	14925	172712	86.41
Extension Workers	83	262.83	21815	102588	21.27

6. Conclusions and policy recommendations

Based on the random survey of 491 farmers of Sichuan, the training performance is very clear. By comparing 6 indexes before and after training, more farmers receive and strengthen safe and scientific technology, and farmers from different areas raise the consciousness and behavior of safety after training. For the indexes which training performance is more obvious

in comparative analysis, as well as the indexes which cumulative variance proportion is higher in factor analysis, we put forward policy recommendations:

First, strict control on pesticide advertisement can protect farmers from fake products, especially on unauthorized label expansion. The extension department then played an important role in leading farmer to select good products that was low residue, low toxin and environmental friendly. Other than the suggestion from extension personnel, retailers and advertisement may also influence farmers purchase.

Second, the training on pesticide poisoning treatment is necessary to demonstration farmers, pesticide retailers, and agricultural techniques extension personnel, especially farmers. So that the farmers can take first aid measures when encountering poisoning cases before the doctors come, and ensure their personal safety and health farthest.

Thirdly, pay attention to burn the pesticide packaging. 52.33 % farmers think it is acceptable to burn the empty packaging after training. Burning container may lead to adverse performance to environment and this should be a reminder to farmers and the later training should aim at change farmers' behavior.

Fourth, treat different area of their training performance differently. It is necessary to consolidate the achievements for the forefront towns of good training performance, so that more farmers consider safe use of pesticide as a habit, and drive more farmers use pesticide safely and scientifically. For the latter towns, strengthen technical training persistently, support by policy, fund and technique, and inspire with more farmers to join the advanced ranks gradually.

Last, the training activities should be regular and systematical in order to consolidate the results. Survey data show that consciousness performance is better than behavior performance when farmers should adopt various measures security in the safe and scientific use of pesticides. So the change of farmers from sense to action will need for some time. The training needs of persistence.

References

A.E. Watterson, H.F. Thomas (1992) Acute pesticide poisoning in the UK and information and training needs of general practitioners: Recording a conundrum. Public Health, Volume 106, Issue 6, November, Pages 473-480

Arcury, TA Quandt, SA Rao, P. Russell, GB. (2001). Pesticide use and safety training in Mexico: the experience of farmworkers employed in North Carolina. Human Organization. Society for Applied Anthropology, Oklahoma City, USA. 60: 1, 56-66

Christos A. Damalas, a, Georgios K. Telidisa and Stavros D. Thanosa. (2008) Assessing farmers' practices on disposal of pesticide waste after use. Science of the Total Environment, Volume 390, No.2: 341-345

Donald J. Ecobichon. (2001). Pesticide use in developing countries. Toxicology Volume 160, No.3: 27-33

Elizabeth J. Z. Robinson, Sumona Rani Das and Tim B. C. Chancellor. (2007). Elizabeth J. Z. Robinson, Sumona Rani Das and Tim B. C. Chancellor. Agriculture and Human Values24:323–332

Gao, L.M., Qin, Z., et al. (2005) Sichuan status and countermeasures of the safe use of pesticide. The annual meeting of Chinese pesticide development in 2005-the work of pesticide quality and safety: 209-303(in Chinese).

George F Czapar, Marc P Curry, et al. (1998). Survey of integrated pest management training needs among retail store employees in Illinois. Ankeny: First Quarter. Journal of Soil and Water Conservation. Vol.53.No.1:31-33

Gu, D.Q., Zhu, T., Xu, S., and so on (2001). Evaluation on prevention and treatment of pesticide intoxication using method of rank sum ratio. Shanghai Journal of Preventive Medicine, Vol. 13, No 6:263-264(in Chinese).

Hanna-Andrea Rother. (2008). South African farm workers' interpretation of risk assessment data expressed as pictograms on pesticide labels. Environmental Research, 108, 419–427

Hewitt, A. (2006). Mosquito control research and training at the University of Queensland Centre for pesticide application and safety. Mosquito Bites - In the Asia Pacific Region. Mosquito Control Association of Australia

Inc., Cleveland, Australia: 1: 2, 23-25.

Kent, JH Pratley, JE (1987). Pesticide use and abuse - the need for training. Proceedings of the Eighth Australian Weeds Conference, Sydney, New South Wales, Australia, 21-25 September, 1987. Weed Society of New South Wales, Sydney, Australia. 278-281

Large Don Curlee. (2005). Training reduces pesticide report card, The Business Journal, Friday, August 5, Page 4

Liu, Y. (2005) Study on the current situation, reasons and countermeasures of pesticide use in China. Territory and Natural Resources Study.No.4: 50-51(in Chinese).

Marcia J Ishii-Eiteman, Nila Ardhianie. (2002) Community monitoring of integrated pest management versus conventional pesticide use in a World Bank project in IndonesiaInternational Journal of Occupational and Environmental Health. Philadelphia: Jul-Sep. Vol. 8, Iss. 3; pg. 220, 12 pgs

Muhammad Aslam Tanvir Ali Zafar, MI Munir Ahmad. (2007). Training needs of fruit growers regarding pesticide use for sustainable environmental health in Punjab. Pakistan Journal of Agricultural Sciences. University of Agriculture, Department of Livestock Management, Faisalabad, Pakistan: 44: 3, 511-517.

Ozkan, HE (1999).Recommendations for pesticide applicator training in USA based on licensing and training procedures in Western Europe. Applied Engineering in Agriculture. 15: 1, 25-30

Panter, KL (1994). Greenhouse pesticide application safety training. HortTechnology. 4: 3, 299-301

Shipp, EM Cooper, SP Junco, DJ Bolin, JN Whitworth, RE Cooper, CJ (2007). Pesticide safety training among farm worker adolescents from Starr County, Texas. Journal of Agricultural Safety and Health. American Society of Agricultural and Biological Engineers, St Joseph, USA: 13: 3, 311-321

Thomas A Arcury, Sara A Quandt, Colin K Austin, John Preisser, Luis F Cabrera. (1999). Implementation of EPA's worker protection standard training for agricultural laborers: An evaluation using North Carolina data. Public Health Reports. Cary: Sep/Oct. Vol. 114, Iss. 5; pg. 459

Whitaker, MJ (1993). The challenge of pesticide education and training for tropical smallholders. International Journal of Pest Management. 39: 2, 117-125

Xun, S.L., Fang, Y., Ma, G., et al. (2005). Sever Problems and Countermeasures about Peasant’s Technical Training. Journal of Jinhua College of Profession and Technology. Vol.5 No. 4 Dec: 22-25(in Chinese).

Zhao, M.C., Zheng, J.Q. (2003). Research on training system of pesticide application technique in China. System Science and Comprehensive Study in Agricultural. Vol.19, No. 4, Nov.:278-281(in Chinese).