B-14.5 Researches on Gas Analyses, Devising Countermeasures and Individual Technical Evaluation of Greenhouse Gases in the Agricultural Field

Contact Person Michikazu Fukuhara
Head, Division of Changing Earth and Agro-Environment
National Institute of Agro-Environmental Sciences
Ministry of Agriculture, Forestry and Fisheries
3-1-1 Kannondai, Tsukuba, Ibaraki 305 Japan
Phone +81-298-38-8272, Fax +81-298-38-8279

Total Budget for FY1990-FY1993 22,906,000 Yen (FY1993 5,188,000 Yen)

Abstract This study makes clear 1) the present energy consumption and CO_2 emission in the field of agriculture, 2) the present consumption of petrochemical products and electricity and its resultant CO_2 emission, 3) CO_2 emission in the production of agricultural material such as fertilizer, agricultural chemicals and films, and 4) the present consumption of energy and CO_2 emission during the agricultural production process such as facilities, that is, greenhouses, hothouses and the operation of agricultural machines. It is also clarified that the features and promise of the techniques of CO_2 emission control, energy conservation and environmental protection in agriculture.

Key Words Agriculture, Greenhouse Gases, Carbon Dioxide (CO_2), Energy Conservation, Environmental Protection

1. Introduction

In recent years global warming accompanied by increasing greenhouse gases has posed international problems. If the sea surface rises, coastal farmland will be submerged. While conserving the environment without deforestation, we must increase agricultural productivity. Such techniques are evaluated in this project.

2. Research Objective

The purposes of this study are to grasp the present energy consumption and CO_2 emission and examine effective means of reducing energy waste and controlling excessive CO_2, and search for fruitful techniques in order not only to conserve the environment but also promote the agricultural efficiency.

3. Research Method

This study analyzes existing documents and materials such as a report on clean energy plan, inter-industry relations table, statistics on energy and economy, comprehensive energy statistics, investigative report on agricultural production cost and so on, and tries to understand energy consumption and its resultant CO_2 emission in agriculture. In addition, the qualitative relationship between fluid assets which is regarded as essential energy (fertilizer, agricultural chemicals, cost of transportation and so forth) and fixed assets (farming machines and implements, barns for agricultural implements, facilities such as storehouses and so on) according to species and crops, the consumption of essential energy and its resultant CO_2 emission are estimated in field husbandry on the whole.

From the standpoint of CO_2 reduction, energy conservation and protected environment, articles about fruitful measures in the future are picked up from newspapers and their good points and improvable points of individual technique in the articles are arranged systematically.

From the standpoint of CO_2 emission reduction, energy conservation and protected environment, 50-item measures as to "agriculture friendly to the earth" are selected. A questionnaire with 50 items is addressed to agricultural researchers of universities and institutes and agricultural extension service personnel nationwide, and thereby the degree of recognition and probability of the measures is evaluated.

4. Result

1) The total energy consumption in Japanese agriculture in 1991 are 7 million ton and the resultant CO_2 emission is estimated at 22 million ton.

2) The consumption of petrochemical products and electricity are 7.894 million kl and 386,870 kWh, respectively. Resultant CO_2 emission is calculated to be 22.3 million ton.

3) The CO_2 emission during the production of agricultural materials such as fertilizer, agricultural chemicals and films is estimated to be 4 million ton.

4) The study makes it clear that 7,228kg of CO_2 per 10a is sent out from such facilities as greenhouses and hothouses necessary for energy to regulate temperature under the process of agricultural production.

5) Through the process of agricultural cultivation, CO_2 emission (kg/10a) by agricultural machines in operation are 70 for rice, 30 for wheat, 42 for rye, 36 for barley, 75 - 101 for soy bean, 39 - 49 for rapeseed, respectively.

6) The questionnaire relating to "agriculture friendly to the earth" and the evaluation of individual technique come to the conclusion that the agricultural function of conserving the environment and the use of clean energy technique in agriculture are necessitated.

5. Discussion

In consideration of the above-mentioned results, CO_2 control means to try in the field of agriculture are as follows.

1) Regarding facilities such as greenhouses and hothouses, i) reduction of warming load by improving protective covering material and other ways to keep crops warm, ii) rise of heating efficiency due to improvement of heat circulation under heating system, iii) harnessing of the energy of the sun and water power as an alternative energy resource of oil.

2) As to agricultural machines, promotion of fuel efficiency, CO_2 control and in particular, development of an energy-saving dehydrater.

3) As to the cultivation of farm crops, reduction of chemical fertilizer, better application of fertilizer and development of CO_2 emission control techniques in field husbandry.

4) A detailed handbook on "agriculture friendly to the earth" will be published.