ANNEX 3

Part B. Summary of Country Reports on Production of Super water absorbent (SWA) by Radiation Processing

(1) Bangladesh (Ms. Salma SULTANA, BAEC)

SWA was prepared by gamma irradiation of carboxymethyl cellulose and acrylamide monomer in solution. The resulting SWA irradiated at 25 kGy for 48 hours exhibited water absorption of around 200 g per g in distilled water and around 50 g per g when swelled in NaCl solution. The product was analyzed for characteristic properties such as gel content, soiling behavior, etc.

(2) China (Dr. Jing PENG, Peking University)

Many factors could affect the water adsorption and water remaining property of SWA, such as monomer, crosslinker, particle size and measurement conditions and so on. The commercial Starch-based SWA has been used in the growth of lemon. Treatment has no obvious affect on the temperature and humidity of soil during the field test. The SWA could improve the height and yield per unit area of lemon and it is helpful to the fruit setting. The validity of Starch-based SWA is about half year. It is easy to be degraded or denatured. Different crops should use different SWA. For the plant with longer growth cycle, synthetic SWA with good mechanical strength is better.

(3) Indonesia (Dr. Darmawan DARWIS, BATAN)

Super water absorbent hydrogel for application as soil conditioner was prepared by radiation grafting and crosslinking of cassava starch with acrylic acid in potassium hydroxide solution using gamma ray with dose ranging from 5 to 20 kGy. The characteristics of hydrogel produced such as gel fraction, swelling capacity in water, water retention of soil, and field capacity of different soil textures were evaluated. The results show that gel fraction increase with increase in acrylic acid concentration. At 5 kGy irradiation dose, gel fraction reached 80% for SWA prepared with composition of cassava/acrylic acid/KOH (10/20/1.2 %). Increase in dose did not give significant increase in gel content. The maximum water absorption was about 250 times of its dry weight for hydrogel with of composition of cassava/acrylic acid/KOH (10/20/0.6 %). The maximum water absorption (swelling) of gel was obtained after immersion in water for 8 hours. Water retention of podzolic soil with SWA (0.6g/kg of soil) is 60 % after 14 days, while without SWA, water retention of podzolic soil is 40%. Water retention of sandy

soil with SWA (0.6g/kg of soil) is 55 % after 14 days, while without SWA, water retention of was only 30%. Field capacity of sandy soil and podzolic soil is 25 and 51, respectively.

(4) Japan (Prof. Mitsuhiro INOUE, Tottori University)
Country report showed that a combination of drip irrigation water with SWA application can significantly enhance the usage efficiency of irrigation salty water compared to fresh water. Understanding the characteristics of absorbents and their interactions with soils as well as the quality of irrigation water would be crucial to the use of CMCs for water management in sandy soils.

(5)Malaysia (Dr. Kamaruddin BIN HASHIM, Nuclear Malaysia)
The super water absorbent (SWA) was made by irradiation of sago waste (SWASw) fiber with acrylic acid solution. The SWA prepared via gamma irradiation exhibited maximum water absorption of 148 g per g dry gel twice that of SWA prepared using EB radiation. The study also revealed dependence of effectiveness of swelling on the size of both SWASw and SWA coconut fiber. The water absorption of SWA coconut is much higher than SWASw. Pot test study showed the release of water from the SWA is very slow. It means both SWA is good retainer of water for agriculture application.

(6) Mongolia (Dr. Amartaivan TSENDDAVAA, Nuclear Research Center, NU of Mongolia)
For SWA production, raw materials can be chosen from agricultural waste materials. And first of all, it would be wheat shell. Also SWA using potato and bentonite can be considered. Target for field and pot test is not decided yet.

(7) Philippines (Ms. Charito ARANILLA, PNRI)
The Philippine Nuclear Research Institute uses k-carrageenan as based material for synthesis of SWA. Carboxmethylation of k-carrageenan renders it crosslinkable and facilitates preparation of SWA hydrogel. The characteristics of the CMkC SWA in terms of equilibrium degree of swelling, water retention properties and biodegradability show the potential of the material for soil amelioration and rehabilitation. In order to carry out field tests, a proposal will be submitted to Department of Science and Technology for funding and collaboration with Department of Agriculture will be initiated.

(8) Thailand (Dr. Phiriyatorn SUWANMALA, TINT)

Superabsorbent was synthesized by radiation-induced graft polymerization of acrylic acid onto cassava starch. The synthetic parameters such as absorbed dose and the amount of monomer were investigated in order to determine the optimum conditions for the grafting polymerization. The criteria are emphasized by the optimum conditions of important parameters to give a maximum amount of water absorption. In addition, water retention, germination percentage and germination energy were determined in order to evaluate the possibility of superabsorbent in agricultural applications, especially in arid regions. The graft copolymer was characterized by FTIR. The results indicated that the sand mixed with 0.1%wt superabsorbent can absorb more water than the sand without superabsorbent. The germination energy of corn seeds mixed with 0.5% superabsorbent was obviously higher than those without superabsorbent. The experimental results showed that the superabsorbent have considerable effect on seed germination and the growth of young plant. The pot tests of Tagetes erecta L. with use of the superabsorbent were positive. The biodegradability test in soil indicated that the weight loss of SWA after nine months was 85%. The result support the role of SWA as a green-material with potential as an alternative to non-biodegradable material for agricultural application. Currently, preparation of superabsorbent in large scale is being done for a field test. The future plan for this project is to establish cooperation with TINT's Business Development Unit in order to carry out a case study for a business potential to commercialize the super water absorbent for agricultural purposes

(9) Vietnam (Dr. LE Hai, VINATOM)

The report presented research results of two SWAs which were prepared by radiation grafting and cross-linking from coconut coir dust and bentonite clay with alkalized acrylic. The characteristics of SWA as water swelling, structural changes, and other factors affect to the swelling has been evaluated. The pot test of strawberries and coffee trees in sandy soil has been developed.

Super water absorbents have been prepared by radiation cross-linking/ and grafting of alkalized acrylic onto the coconut coir dust/ and the bentonite lay. Gel fraction content of both SWAs was around 50%, and swelling degree is 350g.g^{-1} and 550g.g^{-1} respectively. The swelling rate of both types is 34g.g^{-1}.min^{-1}. The evaluation of SWA's useful time and pot test for strawberry and coffee tree in sandy soil has been presented. The novel application of SWA for flood bags was also suggested.

Nowadays SWAs products have been commercialized in Vietnam, and Thanh Phuong and PAS Companies are main distributors for these products.