



Nominee Statement of about 1500 Words

1. Describe the innovation

Prof. Yi has been working in water area for over thirty years. He has been engaged in research and extension of canal linking, low pressure pipeline water conveyance, thin and exposed irrigation for paddy, and economical sprinkler and micro irrigation et al water saving technologies. On the basis of investigation and study, he raised the view that “there also exists the crisis of water shortage in south of China, water conservation should be applied to ease the water shortage, and agriculture should be the focus in water conservation”, and he committed himself to transferring agricultural water saving technology into productivity. He links theory and the practice together, including popularizes the water saving technology for easy understanding and accept by farmers and simplifies complicated technologies for easy operation by farmers, so each water saving technology he studied has been widely extended and applied. As of this, Zhejiang provincial government has held two on-the-spot meetings for extension of water saving technology in Yuyao municipality, over 150 domestic and international experts and 3600 technicians visited and investigated the water saving technology in Yuyao. Partly estimated, the canal linking, thin and exposed irrigation for paddy, and economical sprinkler and micro irrigation et al water saving technologies he studied have been extended over 5.11 million ha of farmland, where 5.15 billion cubic meters of water has been saved, 1.58 billion kilogram of grain has been increased, and 0.30 billion kilowatt of power has been saved all together. Besides ecological benefit, the direct economic benefit is RMB 11.98 Yuan (equivalent to US\$ 1.93 billion).

2. Describe how the innovation saves water

Since the 1980's, he has been exploring the irrigation method for paddy rice that save water and increase yield either. After many years of theoretical study and field experiment, he presented thin and exposed irrigation for paddy rice, which has been widely extended in Yuyao municipality since then. Zhejiang provincial government attached great importance to this technology, so it held on-the-spot meeting in Yuyao municipality for extension of thin and exposed irrigation technology in Zhejiang province. Since 1994, this technology has been extended in Zhejiang province over 4.20 million ha in total, where 3.91 billion cubic meters of water and 0.26 billion kilowatt of power have been saved and 1.45 kilogram of grain has been increased, the economic benefit is RMB 3.63 billion Yuan (equivalent to US\$ 0.70 billion). In 1998 and 2000, experts from IWMI have visited Yuyao twice to investigate the water saving technology for paddy rice, this technical achievement has also been named as “an excellent case of sustainable development in China” by Chinese Academy of



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Sciences (CAS), Tsinghua University and the Ministry of Environmental Protection of China in year 2005, and win the second award for achievement in sciences and technology in Zhejiang province in year 2006. With invitation from China Irrigation and Drainage Development Centre, he joined the writing of the first edition and the second edition of *Water Saving Technology for Paddy Rice* for the training materials of irrigation and drainage technologies organized by the Ministry of Water Resources in years 1997 and 2011 respectively. Prof. Yi's main innovations and achievements in this technology are:

Concluded the disadvantage of long-time basin irrigation for paddy rice. He raised that though paddy needs a lot of water, the root system also needs oxygen, and water and oxygen will increase or decrease oppositely. The long time inundation of land will cause the shortage of oxygen and the accumulation of carbon dioxide and hydrogen sulfide, and therefore cause the degradation of the growing environment of the root system of paddy rice, leading to the root system yellowing, blacking and even death, which affect the absorption of water and nutrient and result in the weakness of paddy straw and thereafter likely to lodging; meanwhile, the long-time inundation will increase the humidity of the farm, therefore induce sheath blight and rice blast et al disease, and result in the huge consumption of nutrient; long-time inundation will cause the huge percolation and infiltration and therefore the loss of fertilizer and pesticide, which will damage the water environment. The above three reasons will reduce the yield of paddy. As of this, Prof. Yi raises that water saving irrigation for paddy rice is not just only a water saving technology, but also a yield increasing technology, and therefore promote the farmers' enthusiasm to apply water saving irrigation for paddy rice.

Invented the thin and exposed irrigation method for paddy rice. For easy understanding and grasp by the farmers, he named the water saving irrigation for paddy rice "thin and exposed irrigation" and expressed as this: "thin" means that the irrigation layer should be as thin as possible, usually around 20 mm; "exposed" means the field surface exposed to the air so that to absorb oxygen and emit harmful gas. For easy memory by the farmers, he also edited the thin and exposed irrigation method into jingle based on the water demand characteristics of paddy rice during its different growing period.

Established water saving irrigation demonstration plot. Established the benchmarking farms of thin and exposed irrigation farm and flood irrigation farm in each town/townships, employed the farmers to record the irrigation quantity, and invited the agricultural technicians to measure the yield of paddy so that to show the farmers with the fact of saving water and increasing yield. As of this, this technology has been widely extended in Yuyao municipality and Zhejiang province.



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Extended no-water-layer irrigation for paddy rice. Prof. Yi found from experiment and practice that as long as there is water from the root system, the paddy can also grow normally even though the straw is not inundated by water, meanwhile, the yield is still very high. Prof. Yi has started to do experiment and demonstrate the no-water-layer irrigation for paddy rice since 1998. With this kind of irrigation, the soil moisture in the field is kept at 100% only in striking root period, then the soil moisture is kept between 70% and 95% to make full use of precipitation and two to six times of irrigation, while there is no water layer on the filed surface. It has been demonstrated from many years of practice that average irrigation quantity is 1000 cubic meters per ha, it can save 53% of water then thin and exposed irrigation, and 72% then flood irrigation. It can also increase by 685 kg/ha and 1080 kg/ha of yield respectively than thin and exposed irrigation and the commonly applied flood irrigation. The water productivity of this kind of irrigation is 2.8 kg/m³. The technical paper about this technology had been presented in the International Symposium on Water Saving Irrigation for Paddy in year 1999. in June 2000, experts from IWMI visited Yuyao and fully affirmed this technology. This technology has been extended in 20 thousand ha in Yuyao municipality.

3. Describe how the innovation was introduced and spread (for Young Professional award, describe how the innovation will be introduced and spread).

From year 1995, based on the topography and water source conditions, Prof. Yi has explored to reduce the cost for sprinkler and micro irrigation. He applied the innovation concept, technical economy technology and optimal design method into the design of sprinkler and micro irrigation, made cost analysis on each part of the system, tried to avoid the waste of materials and equipment functions, and then came into the design theory and design approach of “economical sprinkler and micro irrigation”, with which, the total cost has been reduced by 50%, so it broke through the bottleneck for the extension of sprinkler and micro irrigation.

In year 2008, the minister of Chinese Ministry of Water Resources made comments and instructions on ecological water saving irrigation, the Department of Irrigation and Rural Water Supply as well as China Irrigation and Drainage Development Centre dispatched an expertise team to investigate on this kind of technology, and they affirmed the full extension of this technology in China. In year 2009, Zhejiang provincial government held on-the-spot meeting for the extension of this technology over 67 thousand ha of farmland in Zhejiang province. So far, this technology has been extended in over 630 thousand ha of farmland and 155 thousand ha of livestock farm across Zhejiang province and some provinces in the south of China, it saved 0.94 billion cubic meters of water, and farmers’ net income was increased by RMB 7.25 billion yuan (equivalent to US\$ 1.17 billion). Prof. Yi’s main innovations and achievements in the extension of economical sprinkler and micro irrigation are:



Firstly, he raised the idea of “miniaturization of irrigation unit”. Irrigation unit is the irrigation area covered by one pumping station. The cost for pipes accounts for 50% to 60% of the total, and the cost for pipes is determined by the diameter, while the diameter for pipes is determined by the rotation area. After theoretical calculation and after consulting with the farmers, he concluded that the rotation area is controlled around 0.67 ha, the rotation times is around 15, the irrigation unit area is controlled around 10 ha, and the farmers’ managed radius should be within 400 meters. Secondly, he brought forward the new conception of “permeable lift loss h_{gp} ”. The common approach is to design the sprinkler and micro irrigation, and finally calculate the total lift (H) of the system. While Prof. Yi determines the total lift first, and then get the total lift loss through the main pipes, $h_{gp} = H - h_p$ (pressure of nozzle) – Z(elevation difference between the sprinkling point and the water source) – h_b (lift loss from the branch pipes). Based on this, he inferred the calculation equation of pipe diameter:

$$d = 0.47 \sqrt{\frac{0.948 \times 1.0^3 \times L \times Q^{1.77}}{h_{gp}}}$$

Of which, L is the length of pipes, Q is flow and h_{gp} is permeable lift loss. The calculated diameter with this equation is quite accurate, and therefore it avoided the waste of pipe materials and pump power. Thirdly, he proposed to use PE pipes rather than other pipes, which reduced by half of the total cost for pipes. Fourthly, he proposed to use thin wall and multiple holes sprinkler hose to replace micro sprinkler nozzle, so that the cost can be saved around RMB 4.5 thousand and 6.0 thousand yuan per ha (equivalent to US\$ 0.73 and US\$0.97 per ha). Fifthly, he replaced the thick walls of drip irrigation tube with thin walls, and then reduced the waste of pipe materials caused by blocking of dripholes. Finally, he replaced the expensive fertilizer applicator with the simple negative pressure absorption instrument of pumps.

In summary, “economical” means to optimize design at each section so that to reduce the total cost.

4. Describe the scope for further expansion of the innovation

Since the year 1990, Prof. Yi has started to study the extension of canal lining and low pressure pipe irrigation technologies. He developed three different canal lining types based on the different groundwater table in the plain, developed thin walled and steel wire meshed concrete pipes and various types of water plugs based on characteristics of mountainous area. He was awarded three patents for invention and five patents for utility models with this innovative technology. A total of 2100 kilometers long of lining canals and 110 kilometers long of underground pipes have been constructed with this technology, which increased the canal lining rate in Yuyao municipality to 97 per cent. By the end of 2012, this technology had been extended in over 280



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thousand ha of farmland, saved 0.30 billion cubic meters of water, increased 0.13 billion kilogram of grain, and saved 34 million kilowatt of power, the direct economic benefit is RMB 1.1 billion yuan (equivalent to US\$ 0.18 billion).

5. Describe the roles of the individual nominees

Prof. Yi Yongqing has been engaged in irrigation and drainage for over thirty years, he studied and extended canal lining, pipeline water conveyance, thin and exposed irrigation for paddy rice and economical sprinkler and micro irrigation et al innovative water saving technologies and has made great technological innovations and achievements. After assessment by many academicians from Chinese Academy of Sciences and Chinese Academy of Engineering, these technologies have reached the internationally advanced level. He has been committed to the application of water saving technology into production practice. These technologies have been extended over 5.11 million ha of farmland, where 5.15 billion cubic meters of water has been saved, 1.58 billion kilogram of grain has been increased, and 0.30 billion kilowatt of power has been saved all together. Besides ecological benefit, the direct economic benefit is RMB 11.98 Yuan (equivalent to US\$ 1.93 billion).

In recent two decades, he was awarded 16 patents, and each patent has been applied in agricultural water saving schemes; he published over 40 papers, including 10 presented at international conferences; and he published 4 books. So he has made outstanding contributions to the innovation and conversion of agricultural water saving irrigation technologies.

As of these, we nominated Prof. Yi to apply for the Technology WATSAVE AWARD.