

Evaluation of Flower-Plant Cultivation's Impacts on Rural Soil and Water

---- Case study in Wujin, Middle-East Part of China

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The history of flower-plant (F-P) cultivation in China can be mainly divided into three periods: in 1980s, it existed with the style of small workshops with traditional planting skills, little scale, limited species and dispersed management. From 1991 to 1997, experienced the transforming from planned economy to market economy, this cultivation became basically suitable for industrial management. After 1998, it has been in the primary stage of management industrialization with sharply increased cultivation scale and species. China is in urbanization process and the market demand for F-P is huge and long lasting. The global F-P product demand is with big potential as well. Attracted by the huge market, plenty of districts over China start ornamental plants cultivation and till 2010, the national planting area came up to 918,000 ha from 70,000 ha in 1998 and sales value up to 86.21 billion Yuan from 9.9 billion in 1998. The output value also increased to 0.46 billion US\$ from 3.2 million US\$.

However, though F-P cultivation industry has brought much more economic benefits and job opportunities to local farmers than before and increased the regional greening coverage and beautified the environment, there are environmental problems emerging or being reported especially in the cultivation process which seems not to be sustainable. Firstly, with most farmers holding the misunderstanding that “more fertilizer and pesticide equals

higher land productivity”, widely existed over-usage of chemical fertilizer and pesticide in cultivation (much more than in crops cultivation) are causing farmland soil and nearby water pollution seriously. Secondly, unlike traditional agriculture, it usually takes away a lot of land top-soil for distribution directly leading soil fertility decrease after years. So with the hypothesis that “bringing rapid economic and societal development, F-P cultivation is threatening rural environment”, this research want to confirm and evaluate the impacts caused by F-P cultivation on rural environment mainly on soil and surface water. Wujin, honored with “Chinese Flowers & Plants Township” with more than 20 years flowers and plants planting history, was chosen as a typical case study area. Based on the DPSIR framework as logistic research guidance, we combined interview and structured questionnaire survey and field survey in order to figure out the driver, pressure, state, impacts of F-P cultivation, and then, based on the results, propose the well-targeted recommendations.

We face to face distributed more than 100 questionnaires to local farmers in traditional moving market and received 100 replies. Then, according to responders’ distribution map, we chose two sites (JiaZe and HuangLi town) for field work and finally collected 18 top-soil samples in 20 cm depth from F-P cultivated farmland (3 groups: control, > 10 years, and < 5 years) and 6 surface water samples from nearby-farmland stable water courses for analysis. The top-soil loss field survey was conducted on the main tree species in Wujin, which was divided into 3 categories (seedling, spherical shaped and up-growing trees) by us according to their separate calculating methods of top-soil loss.

According to the results of this research, the findings were as follows: 1) The low education level and no longer young are the internal limitations and the higher income from F-P than crops is the main external driver for the farmers to transfer to F-P from traditional agriculture cultivation; 2) The cultivation methods for farmers are mainly by self-learning and large chemical fertilizer usage (average 1623 Kg/ha/year) and low organic fertilizer usage (36% not use) is widely existed. Also the popular groundwater for irrigation (64% using) is a new finding; 3) Usually the popular container seedlings of trees with a quicker financial feedback are taking away a larger amount of top-soil per km² and cause more serious soil fertility decrease than the up-growing and spherical trees. In addition, a linear relationship is expected and proved between tree's DBH (x) and soil ball's diameter (y) in up-growing trees ($y = 4.5685x$, $R^2 = 0.8526$). Also an exponential relationship was found between each up-growing tree's age (x) and the yearly per unit amount of top-soil loss (y) ($y = 14.219e^{-0.092x}$, $R^2 = 0.8747$). So generally, according to the equation, the yearly top-soil loss situation by trees of different aged common specie in up-growing category can be predicted in a certain extent; 4) The surface water has very serious eutrophication problem after evaluation (100% hyper eutrophication). The obvious soil acidification tendency (pH 0.27-0.3 decrease) and TOC decreasing problem (2-3.6 g/Kg decrease) caused by F-P cultivation is also proved. The large amount of ground water for irrigation in F-P cultivation may lead to big possibility of land subsidence in rural area which needs more attention from the public and the government.

In reality, without external intervention to the farmers, if there is profit, there is cultivation. So, if the farmers continue to cultivate F-P and sell top-soil in current way, the

vicious circle will be caused until the farmland fertility and safety is totally ruined. Then the rural economic development and society stability will break up. Currently the negative impacts caused by F-P cultivation haven't been paid enough attention to by academia, government and farmers. So we hope, through scientific data and logistic story, this research can somehow make contribution directly to stakeholders' better understanding and realization of F-P cultivation in a sustainable way.

Key Words: F-P, Sustainable agriculture, DPSIR, Top-soil loss, Water eutrophication