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January 2013

## Fan Shengzhi Ancient Agronomist

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# Fan Shengzhi

*An agronomist of Ancient China*

DAVID A. BAINBRIDGE

Fan Shengzhi was a remarkable Chinese agronomist. Fan Shengzhi [ 汜勝之 ], originally Fan Sheng 凡勝 ], was born sometime in the late Western Han Dynasty (206 B.C.-A.D. 24) in Sishui county (now northwest Cao county 曹縣, Shandong province, China). He was first an official court gentleman for consultation (yilang 議郎), then agricultural development commissioner (quannongshi 勸農使) and then commissioner of charioteers (qingche shizhe 輕車使者). In these tasks he was entrusted with the revenue of the region of Guanzhong 關中 around the capital, Chang-An (today's Xi'an 西安).

([www.chinaknowledge.de/Literature/Science/fanshengzhishu.html](http://www.chinaknowledge.de/Literature/Science/fanshengzhishu.html)).



Hanshu literary history notes that emperor Chengdi, the ruler from 33-7 BC ([en.wikipedia.org/wiki/Emperor\\_Cheng\\_of\\_Han](http://en.wikipedia.org/wiki/Emperor_Cheng_of_Han)) sent Fan Shengzhi to Sanfu improve yields for resource limited (little land or water) farmers. In the "Book of Jin, food and goods history" it was recorded that "The emperor let the Qingche envoy named Fan Shengzhi guide the wheat crop in the place of Sanfu (now the plain in Shaanxi province)." Liu Hsiang, the Imperial Librarian, noted that he was a state instructor of agricultural affairs and taught in Sanfu (Shi, 1974). People honored him as a master teacher.

Fan Shengzhi was from a peasant family and had practical experience in agriculture, but was also a skilled observer and interviewer and traveled extensively talking to farmers (<http://www.86wiki.com/view/143649.htm>). It was said he sometimes traveled incognito to talk with farmers more easily. It seems likely he also conducted, or had conducted, field trials and experiments. He wrote down what he learned about high yield agriculture and water management, plowing, sowing, soils, fertilizer, the observance of time and weather, growing, harvest, and processing of the crops. His skill in improving yield helped him rise to the office of Censor-in-chief (yushi dafu 御史).

The book he assembled from his experience and observation is the first complete scientific monograph on agriculture in Chinese history and although only fragments remain it is still useful today (<http://www.chinaknowledge.de/Literature/Science/fanshengzhishu.html>; Bainbridge, 2006, 2007). It was variously referred to as “The 18 chapters of Fan Shengzhi” in Hanshu literary history, “the art of planting and sowing, “the planting book of Fan Shengzhi”, or “the agricultural book of Fan Shengzhi.” Later it was more commonly called simply “Fan Shengzhi shu” or “the book of Fan Shengzhi.” During the Tang dynasty Jia Gongyan in the “Zhou Lishu” said, “*The best of the agricultural books in the Han Dynasty was written by Fan Shengzhi.*” The original book was lost in the early Northern Song Dynasty. The existing writings were compiled from fragments of the original writing excerpted from later books. Sadly, only about 3500 words remain.

The crop cultivation techniques recorded in this book reflect the sophisticated and productive agricultural practices developed and in use during the Western Han period. His book created a precedent for discussing different crops separately in Chinese texts and also offered a very modern, scientific approach in discussing expected planting and return rates for crops.

The technology of zoned and pitted fields are described in this important book. This method of cultivation produced very high yields by intensive and meticulous farming. The land was divided into areas of upper, middle and lower value. Pits and trenches were sized for the crop and region to capture rainwater, optimize use of fertilizer, manage irrigation water and drainage, and improve yield (<http://baike.baidu.com/view/109037.htm>).

With annual rainfall between 500-1000 mm in Shandong province, most falling in the summer ([www.travelchinaguide.com/cityguides/shandong/](http://www.travelchinaguide.com/cityguides/shandong/)), there was usually enough water to grow crops if it was well managed. High crop yields were achieved through deep plowing, careful seed selection and planting, precise placement of fertilizer and careful irrigation and weed management. Dust mulch in summer and rolling snow in winter helped conserve precious water. Reported yields of 100 hu per mu (1000 pounds acre) of wheat in pit cultivation are very high (Anderson, 1988). F. H. King (1911) reported similar yields in China in 1909. The US did not reach a comparable average yield until 1906, and consistent yields this high until the 1940s ([www.ers.usda.gov/data-products/wheat-data.aspx#.UiTIXBymznc](http://www.ers.usda.gov/data-products/wheat-data.aspx#.UiTIXBymznc)). Even today in the U.S. wheat yields average only about 2200 pounds (Wheat Foods Council, 2012).

Fan Shengzhiu described a method of treating seeds with fertilizer and organic pesticides before planting ([www.86wiki.com/view/143649.htm](http://www.86wiki.com/view/143649.htm)). He also describes seed selection and plant breeding. The planting and cultivation techniques of many crops were recorded including millet, (the key crop at the time) wheat, rice, bean, hemp, melon, gourd, taro, mulberry and more. Grafting techniques, crop rotation, intercropping, multiple cropping, mixed cropping, buried clay pot irrigation and other innovations, including fermentation

for food storage, were also described in his book (Shi 1974). Clay pot irrigation has proven very effective for water conservation and planting in desert sites (Bainbridge, 2001).

The book of Fan Shengzhi highlights the value of writing as a link across time. Intelligent, hardworking and innovative farmers and agriculturalists had developed very sophisticated solutions to the problems of increasing yields on small land holding with limited water and resources more than 2000 years ago. Their discoveries are still of value today and deserve greater recognition.

### **The Book of Fan Shengzhi**

(<http://www.chinaknowledge.de/Literature/Science/fanshengzhishu.html>)

1. 耕田 Plowing the fields
2. 收種 Harvesting
3. 澆種法 Irrigation
4. 區田法 Field compartments
5. 禾 Grain on the stalk
6. 黍 Millet
7. 麥 Wheat
8. 稻 Rice
9. 稗 Bai Barnyard grass
10. 大豆 Great beans
11. 小豆 Small beans
12. 臬 Xi Nettle-hemp
13. 麻 Ma Hemp
14. 瓜 Melons
15. 瓠 Gourds
16. 芋 Taros
17. 桑 Mulberries
18. 雜項 Miscellaneous items

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[www.travelchinaguide.com/cityguides/shandong](http://www.travelchinaguide.com/cityguides/shandong)

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A formal portrait of Fan Sheng [www.caas.net.cn/caasnew/whgc/hh/56799.shtml](http://www.caas.net.cn/caasnew/whgc/hh/56799.shtml)

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### ***Wheat yields***

China average wheat yield in 1900 about 1000 pounds/acre [FH King](#)

Comparable yield to Shengzhi's time in the US first achieved in 1906 and not reliably reached until the 1940s.

In the United States today one acre of wheat yields an average 37.1 bushels of wheat or 2200 pounds acre, much higher in some regions.

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### ***Climate***

<http://en.wikipedia.org/wiki/Xi'an#Climate>

Xi'an (former Chang-An) has a temperate climate influenced by the East Asian monsoon. Under the Köppen climate classification it is on the borderline between a semi-arid climate (BSk) and humid subtropical climate (Cwa). Most of the annual precipitation falls as rain from July to late October. Snow occasionally falls in winter but rarely settles for long. Dust storms often occur during March and April. Frequent but short thunderstorms develop in summer. The monthly 24-hour average temperature ranges from around freezing 0°C (32°F) in January to 27°C (80°F) in July. Extreme temperatures -21°C (-5°F) in winter to 43°C (109°F) in summer.

### **About the author**

David A. Bainbridge was trained as an ecologist and has worked in sustainable agriculture and restoration of arid lands. He is the co-author of *Sustainable Agriculture for California* (1991), *Self-reliant Agriculture for Drylands* (1986), and *A Guide for Desert and Dryland Restoration* (2007). He retired in 2010 but continues his research on super-efficient irrigation. See for example: [www.academia.edu/3822377/Self\\_Reliant\\_Agriculture\\_Dry\\_Lands](http://www.academia.edu/3822377/Self_Reliant_Agriculture_Dry_Lands), [http://works.bepress.com/david\\_a\\_bainbridge/subject\\_areas.html](http://works.bepress.com/david_a_bainbridge/subject_areas.html), [www.sustainabilityleader.org](http://www.sustainabilityleader.org)