Edamame Production Practices for Small-Scale Farms in China

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Outline

√ Brief Introduction
√ Practices in South China
√ Practices in North China
√ Practices in Northeast China
√ Harvest, processing and uses
√ Concluding Remarks
Vegetable soybeans (*Glycine max* (L.) Merr.), translated as "beans on branches," are the immature, green form of edible soybeans collected at R6-R7 stages

----Konovskiy, 1994

Edamame is the Japanese name for green vegetable soybeans.
Introduction

Differ from field soybeans by being
√ larger-seeded
√ milder-tasting
√ more tender
√ more digestible
√ higher percentage of sucrose
√ rich source of vitamin A,
carbohydrates, protein and iron
♣ It is more nutritious than vegetable green peas.
Introduction

As early as 1620, the Chinese people started to plant Edamame.

Now China is the largest production, consumption and export country of vegetable soybean in the world.

China’s export of frozen Edamame accounted for 52% of the world’s total frozen vegetable soybean export in 2008.
Introduction

Although we have a long history of Edamame cultivation, its production was in a state of farmer’s subsistence before 1970s.

Since 1980s, Edamame cultivars were introduced from Taiwan, and Japan, and scientists started to pay more attention to breeding cultivars adapted to different ecological regions.
Introduction

1999-2014, 53 varieties were released in China.

2010-2014, 5 varieties were released in Northeast China, among them, 2 varieties were released by my group.

The average annual sowing acreage is 400,000ha, with average yield of 5 t/ha.
Introduction

Because edamame
√ is a low input, high nutritional value, short crop cycle, and soil-enriching crop
√ offers quick economic return and higher profit than grain soybean

♦ The Chinese government encourages farmers to plant Edamame

♦ However most production of Edamame are produced by small-scale farms
Grain soybean production distribution

Northeast spring soybean region (50%)

Summer soybean region (35%)

South multiple cropping soybean region

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South multiple cropping region is the major Edamame producer in China, including Zhejiang, Jiangsu, and Fujian Provinces.
Production practices in South China

Varieties

In this region Edamame are planted from February to August, thus varieties could be divided into spring and summer or fall Edamame, based on planting dates.

Fresh vegetable soybean can be supplied about 7 months a year in Yangtze River Basin.
Spring Edamame

This is the main type of Edamame in the region, where Edamame are planted from February to early April. Fresh pods are harvested from May to the end of June.

Spring edamame are widely adapted, short-period growing and photo-insensitive, some of them could also be planted in summer and fall.
√ Summer/fall Edamame

Summer Edamame are planted after winter crops, while fall Edamame are planted after early rice. In general, those varieties are planted in the middle of July to early August. Fresh pods are harvested in the early October until early November.

Summer/fall Edamame are photo-sensitive, and thus early planting will not result in early harvest.
Production practices in South China

Planting patterns:

Depending on the farmers’ land acreage, planting patterns vary

√ The general patterns are
  ---- monoculture
  ---- intercropping or interplanting
  ---- field footpath cultivation
  ---- high tunnel
  ---- protected culture
Production practices in South China

Intercropping:
√ Spring Edamame are usually intercropped with wheat, cotton, sugarcane, faba bean and spring corn
√ Summer/fall Edamame are intercropped with cotton, corn, peanut, sweet potato or other vegetables and fruits (grapevine)
Production practices in South China

Interplanting:
Vegetable soybean ZXD8 were interplanting with pear and orange
Field footpath cultivation:

√ it was the traditional way of Edamame cultivation in Southern China

√ Now less footpath cultivation is available, because of herbicide application and fewer labor.
Production practices in South China

High tunnel cultivation:
direct seeding and transplanting

√ Seed selection: over 98% purity, 95% germination rate
√ Planting Edamame seeds when temperature at 5-cm soil depth is around 8°C
√ Transplanting seedlings to field when simple primary leaves are fully expanded
### Effects of seedling ages on yield and yield components

<table>
<thead>
<tr>
<th>Seedling age (day)</th>
<th>Days to flowering</th>
<th>Days of whole growth period</th>
<th>Plant height (cm)</th>
<th>Branch No.</th>
<th>Internode No.</th>
<th>Pod number per plant</th>
<th>Pod weight per plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>60</td>
<td>95</td>
<td>49</td>
<td>3</td>
<td>9</td>
<td>31</td>
<td>61.6</td>
</tr>
<tr>
<td>15</td>
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<td>42.0</td>
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<td>25</td>
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<td>90</td>
<td>32</td>
<td>3</td>
<td>8</td>
<td>13</td>
<td>25.6</td>
</tr>
<tr>
<td>30</td>
<td>48</td>
<td>88</td>
<td>28</td>
<td>3</td>
<td>7</td>
<td>8</td>
<td>17.2</td>
</tr>
</tbody>
</table>

For transplanting, seedling ages from 10-15 days not only harvest pod earlier but also higher yield, while seedling age over 20 days reduced pod number and yield.
## Production practices in South China

### Comparison between direct seeding and transplanting at different patterns

<table>
<thead>
<tr>
<th>Planting pattern</th>
<th>Treats</th>
<th>Days to flower</th>
<th>Day of whole growth period</th>
<th>Plant height (cm)</th>
<th>Branch No</th>
<th>Internode No.</th>
<th>Pod No Per plant</th>
<th>Pod weight/Plant (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High tunnel</td>
<td>Direct seeding</td>
<td>75</td>
<td>96</td>
<td>52</td>
<td>3</td>
<td>9</td>
<td>26</td>
<td>53.1</td>
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<tr>
<td></td>
<td>Transplanting</td>
<td>70</td>
<td>90</td>
<td>40</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>37.0</td>
</tr>
<tr>
<td>Field cultivation</td>
<td>Direct seeding</td>
<td>54</td>
<td>88</td>
<td>48</td>
<td>3</td>
<td>9</td>
<td>43</td>
<td>87.1</td>
</tr>
<tr>
<td></td>
<td>Transplanting</td>
<td>49</td>
<td>81</td>
<td>36</td>
<td>3</td>
<td>6</td>
<td>39</td>
<td>83.6</td>
</tr>
</tbody>
</table>

At same planting date, transplanting flowers earlier and shortens growth period, harvests earlier and sale earlier due to restricted vegetative growth and accelerated reproductive transformation.
Plastic film mulching is popular in this region to control weed, and have earlier sale.
Production practices in South China

Key pointers for field cultivation: Soil and Preceding Crop

- Well-drained and fertile soil is preferred.
- Do not choose sunflower as the preceding crop because of the frequent infection of soybean *Sclerotinia sclerotiorum*
- Corn is the best preceding crop due to high fertilization rates.
Production practices in South China

√ Seedbed preparation:
   1.8 m seedbed width with row spacing 25-30 cm, 6 rows in each bed

√ Fertilization:
   Compost 15-30 t/ha, NPK compound fertilizer 300kg/ha after seedbed establishment
   Applying urea of 150 kg/ha and potassium chloride of 75 kg/ha at three trifoliate stage
Production practices in South China

Planting density:

√ 120,000 hills/ha
√ 2 seedlings for each hill

<table>
<thead>
<tr>
<th>Plant No. per hill</th>
<th>Hill No/ha</th>
<th>Branch No.</th>
<th>Pod No. per plant</th>
<th>Pod weight per plant</th>
<th>3-seed pod</th>
<th>2-seed pod</th>
<th>1-seed pod</th>
<th>ton/ha</th>
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<td>1</td>
<td>120000</td>
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<td>42</td>
<td>83.6</td>
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<td>27</td>
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<td>10.03</td>
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<tr>
<td>2</td>
<td>120000</td>
<td>3</td>
<td>26</td>
<td>55.8</td>
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<td>3</td>
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<td>7.51</td>
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<tr>
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<td>2</td>
<td>6</td>
<td>3</td>
<td>8.10</td>
</tr>
</tbody>
</table>
Production practices in South China

Weed control:

√ For direct seeding soybean, spray herbicide acetochlor before emergence or
√ Foliar spray haloxytop-R-methyl 750 ml/ha+bentazone 2250 ml/ha at four-trifoliate stage
√ Annual gramineous, broad leaf and perennial grasses including barnyard grass, green bristle grass, siberian cocklebur, dodder weed
Disease control:
Foliar spray 25% Triadimefon or 58% Metalaxyl mancozeb to control soybean blight, rust, and powdery mildew
Insect pest control:

Foliar spray deltamethrin to control aphid and 21% synergistic fenvalerate malathion to control pod borer.
Production practices in North China

√ Edamame rotated with fresh corn and Chinese cabbage is the common practice in Shandong Province, North China
√ This is a year around production system.
√ Edamame is planted in the middle of March, and harvested in the early June;
√ Fresh corn is then planted after Edamame, and harvested in the middle of August;
√ The Chinese cabbage is planted in the late August, and harvested in early November
√Early and cold resistant varieties are recommended
√Fertilization: 25-30 t/ha manure, NPK compound fertilizer of 375-450kg/ha
√Seedbed: Width 1m, height 10-15 cm
√Population: row space 30-35 cm, hill distance 15-20 cm
√Planting depth: 3cm
Production practices in North China

- Spraying herbicide after planting and then cover plastic film.
- Thinning each hill for 2 seedlings when plants are in the 3-trifoliate stage.
- Plowing twice to increase soil temperature.
- Irrigating twice at pod-setting stage.
- Spraying 2%-3% calcium superphosphate or potassium dihydrogen phosphate.
- For avoiding yellow leaf, occasionally plant ash is sprayed on the leaf surface.
√ Edamame is commonly produced with row spacing of 67 cm wide in Northeast China.
Production practices in Northeast China

Spring varieties are usually planted in early May, and harvested in the late August.

Available varieties are CAS No.1, CAS No.2, CAS-117, CAS-1024 and Tai 292.

Rotation with corn is practiced with planting population of 250,000 plants/ha.

Planting depth is critical for emergence, 3-cm or less is preferred.
Production practices in Northeast China

√Fertilization:
15 t/ha cattle manure, 150 kg/ha diammonium phosphate and 50 kg/ha urea at seeding is the common practice.
Potassium sulphate 120 kg/ha at seeding and foliar spray of 4.5 kg/ha potassium after flowering is strongly recommended for Edamame production in this region
Potassium and fresh pod yield

K application increased yield and highest yield was only achieved at 120 kg K/ha not at 180 kg/ha.
Potassium and sucrose content

Our investigation with different K application rates indicated K application enhanced sucrose content but highest sucrose content was only achieved at 120 kg K/ha not at 180 kg/ha.

Sucrose content under different K application rate
We got the similar results for soluble sugar content with highest content at 120 kg K/ha not at 180 kg/ha. This means that application of certain rate K is an approach for vegetable soybean production.
Harvest

Manual Harvest

Machine Harvest

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Harvest

Machine Harvest

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After harvest, fresh edamame pods are screened out into the different categories.
Transportation
Local Market
Processing and utilization

The shelled, raw soybeans are cooked with meat or mixed with other vegetables for various dishes.
Processing and utilization

Standard fresh pods are usually frozen and served with beer

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Processing and utilization

Mature and non-standard edamame can be processed as

Soy milk
Tofu skin
Tofu
Bean curd crust
Processing and utilization

Vegetarian meat

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Processing and utilization

Vegetarian meat
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Processing and utilization
Concluding Remarks

- China is the largest production, consumption and export country of vegetable soybean in the world.

- Most of the Edamame is produced in southern China by small-scale farms.

- Main planting patterns are monoculture, intercropping, protected culture and film plastic mulching.

- Crop rotation is recommended for taste quality and fresh pod yield.
Concluding Remarks

√ Transplanting and high tunnel can have higher yield and early sale.

√ Compost or manure application is essential for edamame production.

√ Potassium fertilizer is strongly recommended for yield and sucrose content.

√ Shelled, raw or frozen edamame can be cooked with meat or mixed with other vegetables.

√ Mature edamame can be processed as soy milk, soy skin, and bean curd.
Thank you
Welcome to Harbin, China