Overview of Indonesian national cotton varieties (Kanesia) in supporting national textile industri

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Abstract. The cotton development program in Indonesia is prioritized to support the national textile industry. Program on Cotton Intensification for Smallholders (IKR) began in 1978/1979 with cotton planted area 15-22 ha and using introduced cotton varieties. The fiber quality of these introduced varieties was appropriate for the raw materials of the textile industry. However, the introduced varieties were not following the Indonesian agroecosystem, especially their resistance to the main cotton pest, namely cotton planthopper, Amrasca biguttulsa Ishida. The purpose of this review is to study the development of Indonesian cotton varieties and their use as raw materials in the textile industry. The development of Indonesian cotton varieties began in 1985 oriented to the varieties with characters on high productivity and resistance to cotton planthopper. In the development of the Indonesian National Cotton (Kanesia) variety, there was an increase in production potential and fiber quality, so that it affected its use in the textile industry. From 1990 to 1998, cotton varieties Kanesia 1 - Kanesia 7 were released with high productivity character orientation, namely 350-902.4 kg fiber/ha and relatively resistant to cotton planthopper with a fiber length of 27.78-31.75 mm (fiber category: medium-long). In 2003 Kanesia 8 and Kanesia 9 were released by improving the character of production and fiber content, id., 650.8-962.2 kg fiber/ha, with fiber lengths of 29.2-30.3 mm (fiber category: medium-long). In 2007 6 new superior varieties were released, namely Kanesia 10 - Kanesia 15 with improved character production potential (586,5-1,178.8 kg fiber/ha), as well as drought-resistant characters for Kanesia 14 and Kanesia 15, fiber length 26,92-29.97 mm (fiber category: medium-long). In 2014, 5 varieties Kanesia 16 - Agri Kanesia 20 were released with improvements to the character of production potential, namely 478.4-1,616.3 kg fiber/ha, and also improvement in fiber quality for the character of strength, elasticity, and smoothness of fiber, with fiber length, 28.7-29.6 mm (medium fiber category). Kanesia 21 - Kanesia 23 were released in 2017 with improvements to the character of production potential, namely 726.1-1,420.3 kg of fiber/ha and improvement in the character of fiber elasticity. Fiber quality is the main character for determining the use of cotton fiber to be processed into yarn (yarn) and the subsequent process to become textile.

1. Introduction

Cotton fiber has an important role as textile raw material. The superiority of cotton fiber which cannot be replaced by non-cotton fiber raw material is that it is easy to absorb sweat or hygroscopic [1]. In the last fifteen years, from 2000 to 2014, the average national cotton fiber production per year was very low at 1400 tons per year and only met 0.23% of the total national cotton fiber needs. This condition causes Indonesia to import 99.77% of the total national cotton fiber needs. The average volume of
imports of cotton fiber from 2000 to 2014 increased by 2.88% per year [2]. The low production of cotton fiber is due to the low application of cotton cultivation technology by farmers, the increasingly narrow area of cotton cultivation, and the reduced interest of farmers to grow cotton due to low selling prices so that farmers are more interested in planting other commodities with higher selling prices [3].

Cotton fiber production in Indonesia from 1975 to 2014 fluctuated but the trend was decreasing. Based on data from the Food and Agriculture Organization [2], in 1975-1978 the average decrease in cotton fiber production was 43.9 percent per year. This is due to high rainfall when the cotton fibers will be harvested so that many crops are damaged. In 1978/1979 the Government entered into the People's Cotton Intensification program (IKR), to increase farmers' production and income, opening and expanding employment and reducing Indonesia's dependence on imported cotton fibers. The IKR program can increase national cotton fiber production in 1979-1986, with an average production increase of 117.85% per year. In 1979 - 2014 cotton fiber production tended to decline, this indicates a continuation of the IKR program was not good. The government created a program to accelerate cotton development in 2007 to encourage increased production of cotton fiber. In 2007 cotton fiber production reached 4,252 tons, which means it increased compared to national fiber production in 2006 which was 542 tons. This situation shows that Indonesia has great potential for the development of national cotton fiber production. In 2008-2014 Indonesian cotton fiber production declined again with an average decline of 11.7% per year. This is due to the interest of many farmers who switch to other commodities that are more profitable so that cotton productivity decreases.

2. Early use of cotton varieties in Indonesia and the constraints of its development

At the beginning of the IKR program in Indonesia, the cotton seeds used were imported seeds. The seed were TakFa 1 from Thailand; Deltapine 16, 55, and 61, Tamcot SP37, South Carolina 1 from the United States; LRA 5166 from India and ISA 205 A from France. Cotton varieties from the United States are smooth and hairless, making them vulnerable to cotton leafhopper (caused by Amrasca biguttula), fruit borer (caused by Helicoverpa armigera and Pectinophora gossypiella). In Indonesia, the annual decline in production due to cotton attacks ranges from 20-40% (4) and in India, it is around 40% [5]. This condition shows that the introduction of cotton which is smooth and hairless leaves is not resistant to Indonesian agroecology for areas designated for the development of cotton, so the use of these varieties in Indonesia is not too long.

Some cotton varieties that have been released since 1990 as superior varieties, named Kapas Indonesia (Kanesia), have their respective advantages including high productivity, relatively resistance to several major pests. Improvement of cotton varieties released is an increase in productivity, content, and quality of fiber and resistance to several major pests. so that it is expected to increase the competitiveness of cotton farms with fiber quality that meet the requirements of the export-oriented national textile industry [6]. The fiber length is divided into five classes: (1) short fiber <21 mm, (2) medium fiber 22-25 mm, (3) medium-long fiber 26-28 mm, (4) fiber length 29-34 mm, and (5) very long fibers> 34 mm [7].

3. Fiber Characteristics of Kanesia Varieties and Their Utilization in the Textile Industry

Kanesia 1 - Kanesia 7 was released from 1990-1998 with high productivity character orientation, i.e. 350-902.4 kg fiber /ha with a fiber length of 27.78-31.75 mm (medium fiber category). In 2003 Kanesia 8 and Kanesia 9 varieties were released with the improved character of production and fiber content, i.e. 650.8-962.2 kg of fiber/ha, with fiber lengths of 29.2-30.3 mm (medium-long fiber category). In 2007 6 new superior varieties were released, namely Kanesia 10 - Kanesia 15 with the improved character on potential production: 586.5-1.178 kg fiber/ha, as well as drought-resistant characters for Kanesia 14 and Kanesia 15, with fiber length 26.92-29.97 mm (medium-long fiber category). Kanesia 21 - Kanesia 23 was released in 2017 by improving the character of potential production, namely 726.1-1.420.3 kg of fiber/ha and improvement in the character of fiber elasticity.

Kanesia 9 has the highest potential fiber content, which is 39.5%. When compared with Kanesia 7, Kanesia 8 and Kanesia 9 have increased fiber strength of 0.6-1.3 g/tex. This condition can improve the
spinning efficiency of weaving yarns in the textile industry which still uses medium speed spinning machines. The resulting yarn fineness increases if the fiber fineness also increases. Kanesia 5 and Kanesia 8 have better fiber smoothness than other Kanesia. Kanesia 3 and Kanesia 9 have a long fiber character that is following industrial requirements, although some industries still need fiber with lengths > 30 mm for certain yarn products. The direction of the development of the spinning machine industry is the engineering of high-speed spinning devices.

According to Paroda & Koranne [8], spinning power, quality, and a class of yarn are determined by the fiber quality character. In fiber trading, the required quality character is 25-28 mm fiber length for rotor spinners and friction or > 30 mm for air-jet spinners, elasticity> 7%, strength > 28 g / tex at 3.2 mm gauge, smoothness 3, 0 - 3.8 mic and maturity> 80%. The class of yarn produced is determined by the strength of the fiber [9]. The use of Kanesia varieties of cotton both in the IKR program and the acceleration of cotton development can increase the average production of cotton fibers in Indonesia, have good fiber content and quality so that Kanesia plays a role in cotton development programs to support the textile industry.

Currently, the cotton development areas in Indonesia are in South Sulawesi, West Nusa Tenggara, East Nusa Tenggara, and Central Java. The area of cotton development is getting narrower and the planting shifts to marginal lands which are rainfed land. This is due to the low selling price of cotton, sometimes even exceeding the production costs incurred by farmers, so that farmers' interest in planting cotton has decreased and switched to planting other more profitable commodities. According to Sulistyoawati & Hasnam [6], crop production in rainfed land will always experience production uncertainties that can negate the results of improved varieties. Planting of superior varieties of cotton must be integrated with water management and soil fertility. The release of new varieties will not have much effect if it is not supported by seed institutions or industries. Multinational companies will not be interested in producing risky plant seeds such as rainfed cotton in Indonesia. Therefore, the Government needs to develop seed business for commodities that have a high risk on rainfed land, at least to be given easy access including financial assistance for users of superior varieties. Also, it is necessary to assist in the application of technology to support the success of the innovation of the new superior varieties and the high productivity expected to be achieved. The government also needs to set cotton prices that can benefit farmers so that the interest of farmers increases to re-plant cotton. If national cotton fiber production increases, it will be able to reduce cotton fiber imports to meet national needs.

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