

TOBACCO DIVERSITY IN INDONESIA

A REVIEW

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ABSTRACT

Tobacco variants in Indonesia are very diverse which can be identified from their morphology or their characteristics. This is related to tobacco long adaptation in different agro ecology of plantation areas which spread out at 15 provinces, from dry to irrigated land and from low land to high land areas. Tobacco has been introduced in Indonesia for more than four centuries and mostly used as cigarette. This commodity and its products are still economically important for government and farmer income. It contributes in government income which reached up to 114 trillion rupiahs and farmer income up to 70% in 2014. Tobacco diversity in Indonesia can be grouped according to their growing season and their usage in cigarette blending. Tobaccos which grown at the end of wet season and harvested in dry season are called Voor Oogst tobaccos, otherwise tobaccos which grown at dry season and harvested in wet season are called Na Oogst tobaccos. Based on their usage, tobaccos are categorized as main ingredients for kretek cigarette, Rolled Your Own (RYO) cigarette, and cigar industries.

Key words: tobacco, diversity, kretek cigarette, cigarette.

INTRODUCTION

Indonesia is well known as kretek cigarette producer country. Cigarette is made from tobacco which mixed with cloves and saucers. Total production of cigarette in Indonesia is about 343 billion pieces up to 2013 and about 321 pieces of it are kretek cigarettes (Sekretariat Jenderal Kementerian Keuangan, 2014). The production is predicted to increase up to 360 billion pieces in 2014 with tobacco demand about 2,880,000 tons.

Tobacco is cultivated as commercial crop in Indonesia. During five years (2009-2013) average tobacco planting area was 230,810 hectares with 197,037 tons of average production (Dirjenbun, 2014). The tobacco is cultivated in 15 provinces with varied ecological characteristics, from dry to irrigated land and from low land to high land areas. The largest planting area is in East Java (48%) and West Nusa Tenggara (24%), the rest of it located in the other provinces.

Tobacco has been adapted as commodity for more than four centuries in many places in Indonesia. Tobacco has high diversity with specific characteristics. Differences in ecological characteristics of tobacco planting areas have yielded specific tobacco quality. The environments have significant influenced on tobacco characteristics for a long period of time. This condition caused many variants of tobacco with different of morphology and characteristics have been found in Indonesia (Suwarso, 2014).

Tobaccos in Indonesia are mostly used for kretek cigarette and cigar productions. Some tobaccos are being processed for roll-your-own (RYO) cigarette and consumed as chewy tobacco. There are 3 groups of tobacco which categorized based on its usage in kretek cigarette, they are filler, semi aromatic, and aromatic tobaccos. However, there are still many types of tobacco which found in several specific locations in Indonesia. They called as their origin name, such as Temanggung, Muntilan, Weleri, Madura, Karangjati, and Payakumbuh tobaccos.

Tobacco remains economically important commodity either for government or for farmers. Cigarette industry tax revenues collected by government in 2014 reached IDR 114 trillion, while tobacco yield contributes to farmer income up to 70% especially in dry land farming area. This paper explains the tobacco diversity in Indonesia with its usages for kretek, cigarette, and RYO cigarettes.

HISTORY OF TOBACCO IN INDONESIA

There is no clear evidence which stated when exactly tobacco was firstly introduced in Indonesia. Tobacco is considered to be brought firstly by a Dutch man named Cornelis de Houtman in 1596 (Toharisman et al., 2008). However, historical Javanese manuscript titled "Babad Ing Sangkala" stated that tobacco first came to Java was brought by Portuguese at the same time of Panembahan Senopati (King of Central Java) passed away in 1602 (Budiman and Onghokham, 1987). Other reference noted that tobacco was brought from Mexico by Spanish who arrived in Philippines in 1575, and then it was introduced to Java in 1601 (Arnez, 2009).

In 1650, tobacco cultivation areas were found in some places, especially in Kedu, Bagelen, Malang, and Priangan. In 1830, tobacco seeds from Manila (Filipina) were planted in Karawang and Pasuruan. The planting areas were widely spread in 1845, especially in Rembang, Semarang, Banten, Cirebon, Tegal, and Surabaya (Suwarso, 2014).

At the early time of introduction, tobacco was mainly used just for self consumption as RYO cigarettes and for noble prize to the king and not for commercial purposes. Smoking habit in Indonesia society has been noticed since 16th century (Budiman and Onghokham, 1987). It was stated in history that the famous king of Mataram Kingdom known as Sultan Agung was heavy smoker. In 1857, tobacco was cultivated firstly by George Berni for commercial purposes as cigar tobacco. The products then exported to Europe. He started to cultivate tobacco in Besuki Regencies

included Jember, Bondowoso and Situbondo areas (PT Perkebunan XVII, 1992).

Expansions of tobacco cropping areas in Java have widely spread since the products were used as main ingredient of cigarette, especially kretek cigarette. Kretek cigarette was created by Haji Djamar, a farmer in Kudus Central Java. He blended tobacco with sliced cloves to make RYO cigarettes in around 1880. Eventually the taste of kretek cigarette was suitable for smokers and became popular as the commercial product. In 1906, private cigarette company owned by Nitisemito has been launched in Kudus, Central Java as the pioneer of kretek cigarette companies in Indonesia

THE IMPORTANCE OF TOBACCO IN INDONESIA

Tobacco crop has an important role in supporting farmer income which indicates that tobacco is promising, especially in dry lands. For example in Temanggung Regency, Central Java, tobacco gave about IDR 35 million up to IDR 45 million/ha/season of net profit to the farmers. In Jember Regency, East Java, farmers have gained net profit about IDR 10 million up to IDR 23 million/ha/season in 2008 (Hadi et al., 2008). The net profit of tobacco in Jember Regency was the highest crop net profit among red chili, wet land rice, hybrid corn, and soy bean.

Table 1. Contribution and profile of Tobacco Farming to Employment in Selected ASEAN countries (2010-2011)

	Indonesia	Cambodian	Malaysia	Philippines	Thailand	Vietnam
Total tobacco farmers	689,360	13,000	3,024	55,533	49,166	220,000
Tobacco farming in agricultural sector (%)	1.61	0.31	0.84	0.47	0.28	0.90
Tobacco farming to total employment (%)	0.64	0.17	0.11	0.16	0.13	0.44
Total planted area (Ha)	216,271	8,308	3,698	38,274.78	28,384.96	26,261
Average yield (mt/ha)	0.63	1.55	1.09	2.07	2.20	1.06

Source: Espino *et al.* (2013)

The numbers of tobacco farmers and total planting area in Indonesia are the biggest in ASEAN countries (Table 1). Tobacco farm insignificantly contributes on employment terms. It contributes only 0.6% to agricultural sector and 1.6% to total national employment. Most of dry land farmers get involve in tobacco agribusiness.

Ministry of Agriculture in Indonesia has policy to make limitation in tobacco area expansion. Consequently, Indonesia has to import tobacco due to the increasing of its demand for cigarette production. This condition has made Indonesia got the negative balance in tobacco trade (Espino *et al.*, 2013).

TOBACCO VARIANTS IN INDONESIA

Based on their usages, tobaccos in Indonesia are categorized into four groups: (1) Cigar tobacco, (2) Kretek cigarette tobacco, (3) RYO cigarette tobacco, and (4) Chewy tobacco. Tobaccos are divided into two groups based on their period of planting time: (1) Voor Oogst and (2) Na Oogst. Voor Oogst tobaccos are tobaccos which planted at the end of wet season and harvested in dry season. Otherwise, Na Oogst tobaccos are the tobaccos which planted at the end of dry season and are harvested in wet season.

Indonesia Sweetener and Fiber Crops Research Institute (ISFCRI) is government research institute which has collected and conserved tobacco germ plasmas. Total conserved plasma germ is 1365 accessions. The tobaccos which commonly found in Indonesia with their usages are presented in Table 2.

Tobacco for Kretek Cigarette

Most of tobaccos which used for kretek cigarette are cultivated in East Java and Central Java, except Flue Cured

Virginia tobacco which cultivated in Lombok, West Nusa Tenggara.

Based on their sold processed products, tobaccos for kretek cigarette are divided into three groups, i.e. sliced dried tobacco, sun cured tobacco, and flue cured tobacco. Sliced dried tobacco is tobacco which processed through leaves sortation based on maturity, fermentation, slicing with size 0.5–1 cm, and sun drying. Variants which include in sliced dried tobacco are Temanggung, Madura, and Paiton tobaccos. Sun cured tobacco is dried tobacco after being processed on leaves sortation and sun drying, such as Kasturi tobacco. Flue cured tobacco is being processed in sortation, yellowing, and oven drying.

Temanggung Tobacco

Temanggung tobacco is categorized as an aromatic tobacco which cultivated around Mount Sumbing and Sindoro with elevation 600–1200 m above sea level. Average of planting area is 11,000 ha per year which spread in 12 Sub Regencies and coverage 108 villages of Temanggung Regency, Central Java.

Temanggung tobacco will gave good taste and aroma in kretek cigarette blend. The best quality of this tobacco is called “Srinthil” with nicotine content about 5–8% with the most expensive price up to IDR 500,000 for each kilogram (Masyarakat Perlindungan Indikasi Geografis Tembakau Srinthil Temanggung, 2013). The best quality of “Srinthil” produced in limited areas which located in Legoksari, Losari, Pagergunung, Pagersari, Tlilir, Wonosari, Bansari, Wonotirto, Banaran, Gandu, Gedegan and Kemloko villages with coordinate location 7°18’30”S and 110°4’0”N. Srinthil expensive price is caused by its limited production in every season.

Table 2. Tobacco types in Indonesia based on their plantation time and their usages.

Tobacco Categories		Variants	Planting Area
Planting Season	Function/Used For		
Voor Oogst :	Kretek cigarette	Temanggung: Gober Genjah Kemloko 1, Genjah Kenongo, Sitieng, and Gober Dalem, Sindoro 1, Kemloko 2, kemloko 3	Temanggung
		Madura: Jepon Kenek, Jepon Tarnyak, Jepon Bukabu, Cangkring, Jepon Dhanangan, Jepon Dhanagan, Jepon Lancor, Jepon Kubis, Jepon Kasturi, Prancak 95, Prancak N 1, Prancak N 2	Sampang, Pamekasan, Sumenep
		Paiton: Ergida, Somporis, Mercy, Paiton 1, Paiton 2	Probolinggo
		Kasturi: Marakot, Jimahmud and Baleno, Kasturi 1, ksturi 2	Jember
		Virginia: Bojonegoro 1, Coker 176, K 326, PVH 3, PVH 10	Bojonegoro, Lamongan, Lombok
Na Oogst :	RYO tobacco	Mole: Nani, Kedu Omas, Kedu Hejo, Leuliwiliang, Dasep, Adung, Nani Kenceh, Darawati	Garut
		Kenceh, Nani, Omas	Sumedang
		Kenceh Kenang, Keplek Iping	Bandung
		Cempaka, Rayud, Jember Sili, Jablay, Arum Manis	Majalengka
		Medan, Miraj	Aceh
		Taram, Guntung, Rudau Gadang, Rudau Ketek, Rudau Andayang, Baruh Gunung.	Payakumbuh (West Sumatera)
Na Oogst :	Besuki NO	Cigar tobacco	Jember (East Java)
	Vorstenlanden		Klaten (Central Java)
	Deli		Deli (North Sumatera)

Total tobacco yield from Temanggung is not enough to supply its demand. Temanggung tobacco demand is about 30,000 tons every year but its supply is only about 9,500 tons. Consequently, Temanggung tobacco planting area is extended to another area, such as Magetan (East

Java), Magelang (Central Java), and Wonosobo (Central Java). These extended areas supply tobacco fresh leaves which then processed in Temanggung as dried sliced leaves.

Many cultivars of temanggung tobacco are also planted by farmers, such as Gober Genjah Kemloko, Genjah Kenongo, Sitieng, and Gober Dalem (Rochman et al., 2007). In 1980, most of farmers cultivated some variants of tobacco such as Kenongo, Sitieng and Ontel. Nowadays, these variants are difficult to be found as cultivars (Suwarso, 2014). All the cultivars have not been legalized yet until Kemloko 1 variety was released in 2001 by ISFCRI. In 2005, Kemloko 2 and Kemloko 3 were released as new superior variants that more resistant to disease than Kemloko 1. Farmers prefer to cultivate Kemloko 2 and Kemloko 3 nowadays, because their superior characteristics, such as their high yield and good quality with nicotine contents 5–6%. Kemloko 2 variant is derived from three times backcross to Sindoro 1 while Kemloko 3 is originated from twice backcross to Sindoro 1 variant. Kemloko 2 has higher yield and higher grade index than Kemloko 3, but it has lower nicotine and less resistant to *Pseudomonas solanacearum* than Kemloko 3. Profiles of Kemloko 2 and 3 are presented in Figure 1.

Madura Tobacco

Madura tobacco is classified as semi aromatic tobacco with nicotine content 3-5%. The average of planting area is 49,454 ha per year which located in some regencies, such as Sampang (3,228 Ha), Pamekasan (29,710 Ha), and Sumenep (16,501 Ha). Tobacco cultivars planted by farmers are very diverse. Cultivars that commonly can be found in field are Jepon Kenek, Jepon Tarnyak, Jepon Bukabu, and Cangkring. Recently, tobacco Jepon Dhanangan, Jepon Dhanagan, Jepon Lancor, Jepon Kubis, and Jepon Kasturi variants are rarely cultivated by farmers (Suwarso, 2014).

Tobacco planting area in Madura is mostly can be found in hill. These planting area are located in eastern part of Mount Tembuku (470 m high), Mount Merangan (398 m high), and Mount Gadu (341 m high). Southern planting area is dominated by lime mineralization and clay texture soil. Rainfall in this area is low with less than 200 mm of average water precipitation in wet season. Microclimate of Madura tobacco planting area is similar to the microclimate of Orient Turkey Tobacco.

ISFCRI has released new variants of Madura tobacco in 2004 with legalized name Prancak N1 and Prancak N2. These two variants were derived from back cross pollination of Prancak 95 and Ishmir Orient tobacco. Compared to Prancak 95, these two new variants have higher productivity, grade index, and crop index, but they have lower nicotine content (Table 3). Prancak N1 and N2 profiles are presented in Figure 2.



Figure 1. Morphology of Kemloko 2 (left) and Kemloko 3 Variants.



Figure 2. Prancak N1 (left) and Prancak N2 (right).



Figure 3. Variety Kasturi 1 (left) and Kasturi 2 (right)



Figure 4. Morphologies of Paiton 1 (left) and Paiton 2 (right) varieties



Figure 5. Fine sliced tobacco for RYO cigarette (left) and sliced tobacco for kretek cigarette (right)

Kasturi Tobacco

Cultivation of Kasturi tobacco is centralized in Jember (9,000 ha) with some part of planting area (3,000 ha) such as in Bondowoso, East Java. Generally, Kasturi planting area is low land with flat topography. Kasturi tobacco cultivation is in May up to June or after paddy rice harvest time.

Many cultivars of Kasturi tobacco which planted by farmers are Marakot, Jimahmud, and Baleno. In 2007, ISFCRI legalized new variants of Kasturi tobacco, Kasturi 1 and Kasturi 2. Kasturi 1 variant has leaves with flat edge, while Kasturi 2 leaves have smooth edge with higher grade index value. These two variants have the same productivity index (1.75 tons dried leaves per hectare).

Paiton Tobacco

Paiton is a sub Regency in Probolinggo, East Java. Central of cropping area is located in eastern Probolinggo around Mount Argopuro, Mount Ringgit, and Madura Strait with latitude less than 150 m above sea level. Soil type in tobacco field is dominated by Alluvial with slope less than 15% of slope. Precipitation amount is 296-2047 mm per year with 3-6 months of dry season. Most of tobaccos are planted on irrigated paddy field, and tobacco is transplanted after harvest of paddy in May or June (Balittas, 1989). Some local cultivars which found in the field are Ergida,

Somporis and Mercy. Paiton 1 and Paiton 2 are new variants which released in 2012 by ISFCRI.

Virginia Tobacco

Virginia tobacco is used either for making kretek cigarette or white cigarette (without clove). This tobacco is mixed with other ingredients in kretek cigarette blend in 70% of concentration.

Table 3. Comparison between varieties Prancak N-1, Prancak N-2 and Prancak 95

Variants	Productivity (ton/ha)	Grade Index	Crop Index	Nicotine content (%)
Prancak N-1	0.9	62.45	60.07	1.76
Prancak N-2	0.8	68.52	56.07	2.00
Prancak 95	0.8	57.12	57.12	2.31

Source: Suwarso et al. (2004)

Virginia tobacco was planted for the first time in Bojonegoro, Bondowoso, and Singaraja Regencies. In 1980, planting area in Bojonegoro was 23,000 ha. Virginia tobacco then cultivated in Lombok, West Nusa Tenggara in 1985 by cigarette industries because Cl content in its cured leaves yielded in previous area was higher than 1.5% which can reduce tobacco quality (Suwarso, 2014). Nowadays, Virginia tobacco planting area in Lombok is more than 20,000 ha, while in Bojonegoro shrunk into 9,000 Ha. Virginia tobac-

co leaves in Lombok are processed as flue cured tobacco, but in Bojonegoro 80% of Virginia tobacco leaves are processed as sliced sun cured leaves.

Virginia tobacco variants in Bojonegoro which required by kretek cigarette industries are Bojonegoro 1, Coker 176, and Coker 319. Hybrid variants of Virginia tobacco in Lombok firstly introduced in 2006 they were PVH 3, PVH 9, and PVH 10.

Other tobacco variants which introduced for making kretek cigarette are Burley and Oriental tobacco. The planting area extension of Burley and Oriental tobaccos were not as fast as Virginia tobacco. The suitable planting area for Burley tobacco plantation is in Lumajang and Jember. Oriental tobacco planting areas are found in Ngawi and Gunung Kidul.

Rolled Your Own (RYO) Cigarette

RYO cigarette is a cigarette which rolled by its consumer own. It is made by rolling a paper which filled with tobacco. Tobacco which used for RYO cigarette is fine sliced tobacco. Main difference of tobacco used for RYO and kretek cigarettes is the sliced tobacco size. RYO tobacco leaves are sliced or cut into less than 2 mm (Figure 5), while kretek cigarette tobacco leaves are sliced into 2–3 cm.

Generally, tobaccos which used for RYO cigarette have high diversity either in their morphologies or their habitat. These tobaccos are commonly described as local tobaccos and can be found in Aceh (Sumatera) until Flores (East Nusa Tenggara).

Hamid (1977) report about the Inventarization Indonesian Tobacco stated that tobacco which locally described as Takengon tobacco is planted in Aceh and centralized in Central Aceh Regency. There are two cultivars which related to their farmer, Medan and Miraj tobaccos. These two cultivars have big broad leaves. However, Gayo cultivar was not cultivated again by farmers because it has very low productivity. Local tobacco of West Sumatera can be found in Limapuluh Kota, Agam, and Solok Regencies. Planting area in Limapuluh Kota is located in Payakumbuh which produces fine sliced tobacco with yellow, black, and brown colors. Cultivars which cultivated by farmers have been known as Taram, Guntung, Rudau Gadang, Rudau Ketek, Rudau Andayang, and Baruh Gunung. In Jambi Province, tobacco is cultivated in Kerinci Regency which spread in Lempur, Lolo, and Kayu Aro sub Regencies. Tobacco cultivar in these areas is very diverse, such as tobacco with long petioles, short petioles, and without petioles leaves.

In West Java Province, tobacco planting areas are found in Garut, Majalengka, Sumedang, Kuningan, and Bandung regencies. Tobacco which cultivated in these areas described as Mole Tobacco which being processed become White Mole, Red Mole, Green Mole, and Black Mole. Cultivars which planted in Garut called as Nani, Kedu Omas, Kedu Hejo, Leuliwiliang, Dasep, Adung, Nani Kenceh, and Darawati (Suwarso et al., 2011). Cultivars in

Sumedang regency described as Kenceh, Nani, and Omas. Cultivars in Bandung regency are Kenceh Kenanga and Keplek Iping. The famous cultivar in Kuningan regency is Peliken with long leaves. Cultivars in Majalengka are Cempaka, Rayud, Jember Sili, Jablay, and Arum Manis (Suwarso, 2011).

Planting areas of fine sliced tobaccos in East Java Province are found in Bondowoso and Situbondo Regencies. Wringin cultivar is found in Wringin and Pakem districts of Bondowoso regency, while tobacco in Situbondo is described as Kayumas tobacco with Jepon and Kasturi Kayumas cultivars.

CIGARETTE TOBACCO

Besuki NO tobacco

Cigarette tobacco in Indonesia known as Besuki NO, Vorstenlanden, and Deli tobaccos. Besuki NO is produced in Jember Regency (East Java) and mostly managed by Government Estate Company and Private Leaf Exporter Companies. Besuki NO tobacco is exported to Europe but the supply is continuing to decrease. Eventhough its wrapper and binder qualities are also demanded by consumers.

In the early of extension, North Jember had been chosen as the central of Besuki cigar tobacco planting area which then processed as cured leaf (Lembaga Tembakau, 1999; Damberger, 2000). However, due to the declining of tobacco production because of tobacco disease, Besuki tobacco planting area has been extended to South Jember (Rachman et al., 2001). Cigar tobacco produced in South Jember used as cigar wrapper and binder which its price is higher than its filler quality.

Tobacco yield in South Jember is higher than in North Jember. This condition caused by higher rainfall in South Jember than North Jember. The difference characteristics of area between South and North Jember may also influence their agro-ecology characteristics which determine tobacco yield and quality. Unfortunately, there is no information about the correlation between agro ecology with tobacco yield and quality in South Jember. Consequently, the available crop technologies have not significantly increased the yield and quality of cigar tobacco (Djajadi, 2008). Tobacco variant which popular to be cultivated is H382. Tobacco variants which still can be found in the field are H362 and H877 (Suwarso, 2014).

Vorstenlanden tobacco

Planting area of Vorstenlanden tobacco is in Klaten Regency, Central Java. Vorstenlanden tobacco was firstly introduced to Klaten in 1858. It started to be exported to Europe in 1863 (Hartana, 1980). Nowadays, its planting area is about 1,500 Ha under the management of PTPN X (Kurniawati et al., 2009). The Vorstenlanden tobacco is mainly used for wrapper (omblaad) and binder (dekblaad) in cigarette production.

Deli tobacco

Deli tobacco is cultivated in Deli of North Sumatera Regency which popular in Europe market, especially at Tobacco Auction Hall in Bremen. However, the prestige of Deli tobacco in the international market has elapsed. Deli tobacco supply has declined from year to year. The cultivation of it is managed by PTPN II. Problem which faced by management is land conversion which causes the declining of planting area. Deli 4 is tobacco variant which commonly planted in this area.

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REFERENCES

- Arnez, M. 2009. Tobacco and Kretek: Indonesian Drugs in Historical Change. *South-East Asian Study*: 49-69.
- Budiman A and Onghokham. 1987. *Rokok Keretek dan Lintasan Sejarah dan Artinya bagi Pembangunan Bangsa dan Negara*. PT. Djarum. Kudus.
- Damberger A. 2000. Quality remains top priority. *Tji Tobacco Journal*. 3(1) : 21-23.
- Djajadi. 2008. Besuki Tobacco Cigar: Crop Area Extension and Its Contrainst in South Jember. *Perspektif* . 7 (1): 12 – 19.
- Dirjenbun, 2014. *Estate Crops Planting Area and Productivity in Indonesia*. Direktorat Jenderal Perkebunan. Jakarta.
- Hadi PU, Kustiari R. Anugerah IS. 2008. Case study of Tobacco Cultivation and Alternative Crops in Indonesia. *Indonesian Center of Agriculture Socio-Economic and Policy Studies*. Department of Agriculture.
- Hamid A. 1977. Collection of Indonesia Tobacco. *Pemberitaan LPTI* 14: 1-16.
- Hartana, 1980. *Cultivation of Cigar Tobacco*, Jember Research Institute.
- Kurniawati F, Martini R, Bernaldy BA. 2009. Variation in Income the Community Around PT. Nusantara X (Persero) Klaten Government Crop Estate. *Buletin Ilmiah Instiper*. 16 (1): 48-54.
- Lembaga Tembakau. 1999. *Perkembangan ekspor impor tembakau Indonesia*. Makalah dalam Pertemuan Teknis Tembakau Ekspor 1999 di Jember. 6 pp.
- Masyarakat Perlindungan Indikasi Geografis Tembakau Srinthil Temanggung. 2013. *Tembakau Srinthil Temanggung*. 70 pp.
- Rachman A, Purlani E, Dalmadiyo G. 2001. Using of spray irrigation method on Besuki NO cigar tobacco. *Journal og Agricultural Science*. Gadjah Mada University (9) 2: 85-92.
- Rochman F, Suwarso, Murdiyati AS. 2007. Promising lines of temanggung tobacco which have height yield anf resistant to disease. *Journal of Industrial Crop Research*. 13(2): 57-63.
- Secretary General of Indonesia Ministry of Finance.. 2014. *Response Strategy of Governmet Income*. Finance Media. Vol IX. No 82: 18-20.
- Suwarso. 2014. *Source of Tobacco Genetic: Management Status and Application* (in *Source of Genetic Agriculture: Food, Estate, and Horticulture Crops* Eds Sumarno, Hasnam, I. Mustika, and Bahagiawati). IAARD Press. 165-185.
- Suwarso, Djajadi, Firdian A, Sobur E. 2011. *Exploration and Identification of Local Garut Tobacco*. Research Report of Cooperation Research between Garut Estate Institution and Indonesia Sweetener and Fiber Crops research Institute.
- Toharisman A, Sugiarto, Guntaryo. 2008. *Java Tabak: Cigar Tobacco*. PTPN X. Surabaya. 151 p