

## Overview of the Occurrence of Green Tobacco Sickness (GTS) in Tobacco Farming Areas: A Literature Review

Enggal Hadi Kurniyawan<sup>1)</sup>, Alfid Tri Afandi<sup>1)</sup>, Shindy Gentsia Rahardika<sup>1)</sup>, Fika Putri Kharisa<sup>1)</sup>,  
Septiani Eka Lestari<sup>1)</sup>, Aril Alifia Salsabila<sup>1)</sup> and Ahmad Zainuri<sup>1)</sup>

<sup>1)</sup> Faculty of Nursing, Universitas Jember, East Java, Indonesia

E - mail : enggalhadi.psik@unej.ac.id

**Abstract:** *One of the occupational health risks of tobacco farmers is Green Tobacco Sickness (GTS). The large number of Green Tobacco Sickness incidents nationally and internationally experienced by green tobacco farmers has led to a great deal of research being conducted to determine the process of occurrence of the disease, the impact on health and other fields, the prevention, and management of this disease. The method used in this literature review is to re-expose published information and then return briefly without reducing the essence of the topic of discussion. The journal used in making literature reviews was obtained from 3 database source, namely Google Scholar, Pubmed, and Science Direct published between 2018-2021. The aim of the study was to describe the incidence of Green Tobacco Sickness in the farmers in the green tobacco farming area. The conclusion of this study is based on some research, it is stated that tobacco farmers already understand about GTS and the symptoms that can arise due to GTS. However, several other studies have shown that the educational level of tobacco farmers is included in the low category where this can affect workers to protect or prevent diseases caused by the work they do. Based on these results, it is hoped that there will be a role for nurses who can support the reduction of Green Tobacco Sickness (GTS) cases such as counseling to green tobacco farmers about the dangers of GTS and prevention efforts such as using good and correct PPE.*

**Keywords:** *Green Tobacco Sickness, Tobacco farmer, Occupational health risk, Agronursing*

### INTRODUCTION

As an agricultural country, Indonesia is in the sixth position as the largest tobacco-producing country in the world. Indonesia's tobacco production is as much as 136 thousand tons per year (Rokhmah et al., 2019). The high production of tobacco will affect the health of workers in the tobacco fields. Tobacco farmers will be very at risk of occupational disease (Andriany et al., 2019). Occupational health risk are potential dangers and hazards that exist in the workplace that can have a negative impact on the health and welfare of workers (International Labour Organization, 2019). The activities of tobacco workers which include sowing, fertilizing flower buds, spraying pesticides, or herbicides,

harvesting, and separating leaves will cause health problems for tobacco farmers (Alves et al., 2020). One disease that can occur is *Green Tobacco Sickness*. The incidence of GTS among farmers is influenced by the failure of tobacco farmers to use personal protective equipment (PPE) (Andriany et al., 2019).

*Green Tobacco Sickness* (GTS) is an occupational disease that often occurs in workers in the tobacco industry. Green tobacco sickness is acute nicotine poisoning due to direct skin contact with wet green tobacco leaves (Park et al., 2018). The risk of GTS will increase when farmers' clothes or tobacco leaves get wet from rain, dew, or sweat. Headaches, dizziness, nausea, vomiting, and seizures are common symptoms that arise

from GTS (Park et al., 2018). High rainfall, humidity, and wet tobacco leaves also increase the risk of GTS (Alves et al., 2020). Several risks cause GTS, including work experience, type of work, and not using Personal Protective Equipment (PPE) (Andriany et al., 2019).

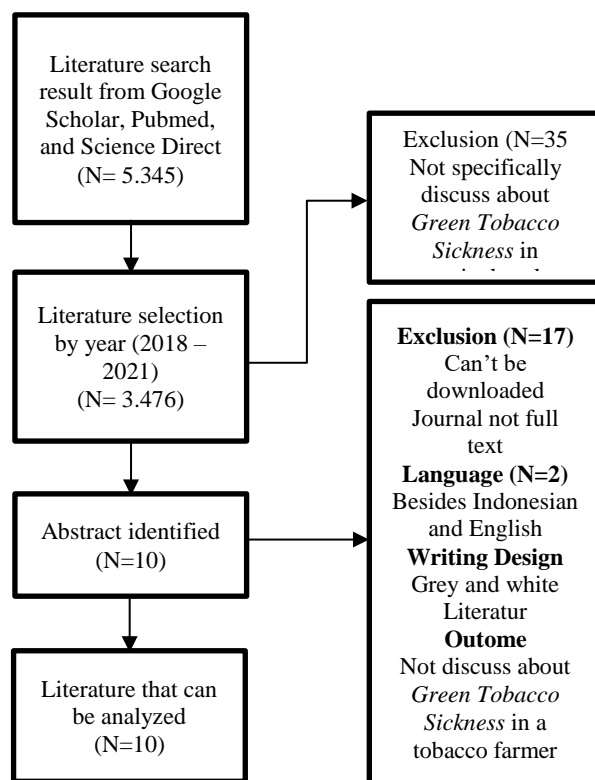
The high number of tobacco farmers in Indonesia continues to increase every year, there were 786,222 workers in 2012 (Andriany et al., 2019). The largest tobacco producers in Indonesia are Central Java, East Java, and West Nusa Tenggara. However, research on GTS is still low. Based on several studies, the incidence of GTS in Temanggung is as much as (63.7%), and in Jember as much as (66%) (Andriany et al., 2019). So, there is a need for health management that focuses on agriculture and plantations. Agronursing is the management of nursing services and nursing care, within the scope of agriculture, plantations, fisheries, animal husbandry, or agro-industry (Kurniyawan et al., 2023). So that agronursing can be applied in the management to prevent and treat cases of disease caused by green tobacco.

**METHOD**

The method used in this review of literature uses the method of re-exposing information that has been published and then returning briefly without reducing the essence of the topic of discussion. The journal used in making literature reviews was obtained from 3 database source, namely Google Scholar, Pubmed, and Sciendirect published from 2018 to 2021 using Indonesian keywords, namely "Green Tobacco Sickness" OR "Tobacco farmer" OR "Agriculture" OR "Occupational health risk" OR "Agronursing".

The article search process is carried out by identifying keywords that have been determined. After keyword identification, 5.345 articles were obtained and then filtered to produce as many as 3.476 articles in accordance with the predetermined research time. Furthermore, articles that have been screened in accordance with keywords are screened so that 10 articles are obtained by selecting the title and year of publication in accordance with the assessment criteria. Then, from the 10 selected articles, 10 journals were obtained that would be reviewed

according to the research criteria and proceed to the analysis step.



**Figure 1.** Flow Diagram of Analysis Literature Based on PRISMA (2009)

**RESULTS AND DISCUSSION**

Respondents involved were 100 people consisting of 83 men and 17 women. The age range of the respondents is 24-78 years with an average age of 50 years. Most of the respondents have a low level of education (84.0%) and the rest have a high level of education (16.0%). The breakdown of education level is 16.0% did not attend school, 57.0% graduated from elementary school/equivalent, 11.0% graduated from junior high school/equivalent, 13.0% graduated from high school/equivalent and 3.0% from university. The working time range of the respondents per day is between 4-11 hours/day with an average of 8 hours/day. Meanwhile, for the average length of work the respondents had been cultivating tobacco farmers for 34 years (Vita dkk., 2020).

From the research results it was found that out of 100 respondents 76.0% did not go to a health service to treat GTS symptoms and 24.0% went to a health service to treat GTS symptoms.

Of the 76.0% of respondents who did not go to health services, 43.0% did not take medication and 33.0% self-medicated. The reasons for respondents not seeking treatment were because respondents felt they could recover on their own (31.0%), respondents could still work (10.0%), and the rest did not want to seek treatment (2.0%). Respondents who self-medicated by buying medicine at stalls were 8.0%, using traditional ingredients as much as 25.0%. For respondents who went to health services by going to the midwife as much as 15.0% in the village and going to the puskesmas as much as 9.0%. Based on these results it can be seen that the respondents felt that the symptoms of Green Tobacco Sickness they were experiencing were not severe and did not need treatment as soon as possible. This could also happen because the respondent's perception of seeking treatment is still not good (Vita dkk., 2020)

The GTS group does not consume alcohol, no experience subjective complaints, and are more likely using self-protection measures, but categorized into abnormal nutrition group (underweight and overweight), has poor personal hygiene, has a main job as a farmer or land owner, has an additional work, have worked for  $\geq 8$  hours per day, engaged in high-risk work, have time off  $\leq 18$  hour per day at work, and have poor OSH Measurement. The results of this study indicate that gender and nutritional status associated with incidence of GTS in tobacco farmers (Sujoso dkk., 2020). Among the cases that met the definition of GTS, the incidence was 15 out of 40 people (37.5%). By sex, women had a significantly higher incidence (55%) than men (20%). There was no significant difference in age (Table 2). In addition, GTS incidence was significantly higher in nonsmokers than in smokers (57.7%) (Park dkk., 2018).

The use of manual and electric stove was reported by 88% and 26% of the farmers, respectively. More than half of the participants wore humid clothes by the time of the harvest, which mostly occurred in the morning and afternoon times (96%). Skin injuries by the time of the tobacco harvest were reported by 9% of the farmers and one third of them reported to having gotten sick in up to three days after the tobacco

harvest. Cultivation of bean (89%), corn (95%), vegetables, fruits, and legumes (92%), wood (50%), and rice (2%) were present besides tobacco. Referring to pesticides, 87% reported to use such chemical compounds, with 30% of them reporting having started their use as early as the age of 15. Only 15% of the pesticide users reported to having using full PPE, and 30% got sick after the application of such compounds (Campos dkk., 2020).

A difference between cases and non-cases was observed for the variables age, smoking, time of sunlight exposure, and bean cultivation. Higher educational level, as well as higher frequencies of former smokers, manual crop cleansing, and wood cultivation, were seen for males in the stratified bivariate analysis by sex. Furthermore, getting sick during or up to three days after the harvest presented an association to the disease among males. Referring to females, the cases were younger and presented higher time of sunlight exposure. An association between GTS and bean cultivation, skin contact with tobacco leaves, and exposure to pesticides was also seen for females. Considering smoking, both smoking and non-smoking subjects, the non-cases were older. Other GTS associated variables among non-smokers were time of sunlight exposure, bean cultivation, and exposure to pesticides. Lower educational level and higher frequency of subjects who presented abusive alcohol use were seen among the cases in smokers (Campos dkk., 2020).

Fifty percent of the nicotine-exposed farmers developed GTS. Symptoms of GTS in the farmers are listed. The most frequent complications were nausea (48%), abdominal cramps (48%), headache (45%), vomiting (15%), and dizziness (5%). Fifty percent of the farmers had two or more symptoms. All participants recovered within 2-3 days. No gender-specific differences were observed in regard to the occurrence of the disease and its symptoms (Alves dkk., 2020).

Symptoms of GTS like nausea, dizziness, poor appetite, insomnia were reported more in tobacco growers ( $p < 0.01$ ). On FND assessment, 63% had moderate to high dependence. On AUDIT assessment, 55.07% growers who had drinking habit had hazardous drinking behavior.

Logit function model was used to assess parameter estimate (OR) on substance abuse. In Fagerstrom and AUDIT scale model -Odds Ratio were less than one (i.e. protective effect) shown among the predictors (duration of working in farms and area

utilized for farming) increases, the odds of the outcome (substance abuse-smoking and alcoholism) occurring decreases (Muniswamy dan Maliakel, 2021)

**Table 1.** Result of Literature Review

ID Number	Author and Journal Identity	Journal Title	Population and Sample	Method	Summary of Result
A1	<b>Author:</b> Vita Permatasari, Syamsulhuda Budi Musthofa, Priyadi Nugraha Prabamurti  <b>Jounal Identity:</b> Jurnal Pengabdian Masyarakat (e-Journal) Volume 8, Number 2, March 2020	Factors Associated Between Treatment-Seeking Behavior Symptoms of Green Tobacco Sickness (GTS) with Tobacco Farmers In Bansari District, Temanggung Regency	Population used are all tobacco farmers in Basar District. The sample used as many as 100 samples with the technique multistage random sampling.	The study design used is cross sectional.	76.0% of respondents did not go to health services, with details of 43.0% did not take treatment and 33.0% did self-medication for symptoms of Green Tobacco Sickness. Respondents have good knowledge, perceived benefits, self-efficacy and support from family & friends. Respondents have high perceived barriers.
A2	<b>Author:</b> Jodel Alves, Fernanda R. Da Silva, Vivian Kahl, Juliana Reyes, Elisiane Lima, Marina B. Abreu, Flávia V. Thiesen, Denise Leal dos Santos, Mirian Salvador, Cátia dos Santos Branco, Armen Nersesyan, Siegfried Knasmuller, Juliana Da Silva	Impact of nicotine-induced <i>Green Tobacco Sickness</i> on DNA damage and the relation with symptoms and alterations of redox status in tobacco farmers	In the city of Santa Cruz do Sul. The region has an overall population of approximately 120,000 inhabitants.	We conducted 1:1 matched case-control study between 2011 and 2014 in the surroundings of	The symptoms of GTS included nausea, abdominal cramps, headache, vomiting and dizziness, and 50% of the workers had more than one symptom. This effect was more pronounced in participants with GST compared to healthy nicotine exposed workers and increased in individuals with specific symptoms (range 22–36%).

ID Number	Author and Journal Identity	Journal Title	Population and Sample	Method	Summary of Result
A3	<p>Ecotoxicology and Environmental Safety Volume 206, 15 December 2020, 111397</p> <p><b>Author:</b> Sri Wahyuni Adriani, Rendy Anggriawan, Muhammad Thoriq Al Imani, Andri Wahyudi</p> <p><b>Journal Identity:</b> Jurnal Pengabdian Masyarakat Ipteks/2021/Vol. 7, No. 1, pp. 38-45.</p>	<p>Health Education to Prevent Green Tobacco Sickness in Tobacco Farmers</p>	<p>The population of this study was a group of tobacco farmers in Sumberwaru Village, Sukowono District, Jember Regency with a sample of 23 partners.</p>	<p>The implement ation method uses health screening, health education about GTS and the importance of using personal protective equipment (PPE) when working in tobacco processin, and training on the use of PPE for farmers.</p>	<p>Research through health education activities showed results, namely an increase in farmers' knowledge about Green Tobacco Sickness (GTS) after being given health education. In addition, health education can also improve farmer behaviour in using personal protective equipment (PPE) when working in tobacco processing.</p>
A4	<p><b>Author:</b> Élida Campos, Vanessa Indio- do-Brasil da Costa, Sérgio Rabello Alves, Ana Cristina Simões Rosa, Bárbara Rodrigues Geraldino, Beatriz da Cruz Meira, Valéria Cunha, Tânia Maria Cavalcante, Silvana Rubano Turci, Marcia Sarpa, Ubirani Barros Otero</p> <p><b>Journal</b></p>	<p>Occurrence of <i>Green Tobacco Sickness</i> and associated factors in farmers residing in Dom Feliciano Municipality, Rio Grande do Sul State, Southern Region of Brazil</p>	<p>This study used a population of tobacco producing familiar farmers, residing in Dom Feliciano Municipality, from both sex, adults (over 18 years old), able to understand and answer the questionnaires, and speaking Portuguese. This study used 354 samples who participated in the survey and a minimum sample size of 210 subjects.</p>	<p>The research used a cross-sectional study with several data collection methods, including through interviews, filling out the questionnair e, biological analysis, and statistical analysis.</p>	<p>Research on a population of tobacco farmers with 354 samples in Dom Feliciano Municipality shows that to determine cases of GTS significantly can use urinary cotinine as a biological marker that influences the distribution of disease prevalence by sex. In addition, research indicate an association between GTS cases and sunlight exposure, wood cultivation, use of pesticides, and health perception.</p>

ID Number	Author and Journal Identity	Journal Title	Population and Sample	Method	Summary of Result
A5	<p><b>Identity:</b> Cadernos De Saude Pùblica/2020/3 6(8):e0012271 9</p> <p><b>Author:</b> Anaclaudia Gastal Fassa, Neice Muller Xavier Faria, Ana Laura Sica Cruzeiro Szortyka, Rodrigo Dalke Meucci, Nadia Spada Fiori and Maitê Peres de Carvalho</p> <p><b>Journal Identity:</b> International Journal of Environmental Research and Public Health 2021, 18, 12255. <a href="https://doi.org/10.3390/ijerph182212255">https://doi.org/10.3390/ijerph182212255</a></p>	<p>Child Labor in Family Tobacco Farms in Southern Brazil: Occupational Exposure and Related Health Problems</p>	<p>In this project, 2469 workers were studied; however, only individuals under the age of 18 were included in this article. The sample was selected from 3851 invoices provided by the Municipal Treasury Department, referring to tobacco sales and issued in 2009.</p>	<p>With a cross-sectional study of a random sample of tobacco farmers in the municipality of São Lourenço do Sul, southern Brazil, during the 2011 harvest.</p>	<p>Approximately 25% of the interviewees reported experiencing <i>Green Tobacco Sickness</i> once in their lifetime, and 13.3% reported experiencing it three or more times. Among workers aged 14 to 17 years, 3.5%, all male, reported pesticide poisoning during their lifetime. Regarding respiratory symptoms, 16.2% of young people reported a cough without a runny nose, and 6.1% reported wheezing in the past 12 months. As for musculoskeletal disorders, low back pain is the most common, affecting 29.3% of workers and increasing with age, with a frequency of 39% among workers aged 16 and 17 years. Thoracic spine pain in the past year was reported by 26.3% of workers. Neck pain in the last year was reported at 3.0%, all of them were female.</p>
A6	<p><b>Author:</b> Sung-Jun Park, Hyun-Sul Lim, Kwan Lee, Seok-Ju Yoo</p> <p><b>Journal Identity:</b></p>	<p><i>Green Tobacco Sickness Among Tobacco Harvesters in a Korean Village</i></p>	<p>Our study was conducted in Cheongsong-gun, a rural city located in Gyeongsangbuk-do, Korea. This study was approved by Dongguk</p>	<p>We measured cotinine concentrations, and administered a questionnaire survey to tobacco</p>	<p>Urine samples were collected at the following times: morning (T1), after work in the morning (T2), after work in the afternoon (T3), after dinner, before going to bed (T4), and the following year when</p>

ID Number	Author and Journal Identity	Journal Title	Population and Sample	Method	Summary of Result
	Safety and Health at Work 9 (2018) 71-74.		University Hospital's clinical research review board prior to study commencement.	harvesters in Cheongsong-gun, Gyeongsangbuk-do, Korea. We repeatedly measured urine cotinine concentration five times with a questionnaire survey.	participants were not working (T5). As shown, urinary cotinine was measured five times. The highest concentration was at T1 of 500.71 (geometric standard deviation, 4.67) ng/mg Cr, but there was no significant difference based on time (T1eT4). Participants' concentration during the non-working period [135.40 (1.73) ng/mg Cr;T5] was significantly lower than when they were working (p < 0.01).
A7	<p><b>Author:</b> Dewi Rokhmah, Isa Ma'rufi, Khoiron</p> <p><b>Journal Identity:</b> <a href="https://doi.org/10.1088/1755-1315/243/1/012090">IOP Conference Series: Earth and Environmental Science</a>, 2019, Volume 243 No.1, p. 012090. <a href="https://doi.org/10.1088/1755-1315/243/1/012090">https://doi.org/10.1088/1755-1315/243/1/012090</a></p>	Incidences of <i>Green Tobacco Sickness</i> (GTS) on Tobacco Farmer and Prevention Efforts Through Social Capital Utilization in Indonesia	The study population was tobacco farmers from 12 tobacco districts in Jember Regency. There were 322 respondents who were randomly sampled, from May to November 2017.	Mixed quantitative and qualitative research methods with an analytical process using a cross sectional approach to determine the incidence of GTS in tobacco farmers.	<i>Green Tobacco Sickness</i> (GTS) occurs in women more than one and a half times compared to men. Tobacco pickers come from three groups: young workers, family members of farmers, and child workers <17 years. Tobacco farmers are mostly married and work as tobacco farmers within 1-10 years and have knowledge of tobacco farming from generation to generation. The majority of tobacco farmers stated that they did not attend school or only graduated from elementary or junior high school.
A8	<p><b>Author:</b> Megah Andriany, Kusyogo Cahyo, Aditya Kusumawati</p> <p><b>Journal</b></p>	Relationship between Knowledge and Perceptions of Occupational Health	The population of this research is tobacco farmers who live and work in Kendal Regency as many as 4,628	Research using descriptive correlation method. Retrieval of data by	Good or bad knowledge regarding safe work behavior has a percentage of 50%. Safe work behavior includes the use of PPE and personal hygiene.

ID Number	Author and Journal Identity	Journal Title	Population and Sample	Method	Summary of Result
	<p><b>Identity:</b> Jurnal Ilmu Keerawatan Komunitas, Volume 2, No 1 (1-7), 2019. <a href="https://doi.org/10.32584/jikk.v2i1.299">https://doi.org/10.32584/jikk.v2i1.299</a></p>	<p>Problems and Tobacco Farmers' Personal Protective Equipment Use Behavior</p>	<p>samples selected by simple random sampling method, the minimum number of respondents is 90 people.</p>	<p>survey method. Statistical data analysis with univariate analysis to describe the characteristics, knowledge, and perceptios of the respondents.</p>	<p>The last respondent's educational level did not finish elementary school (44.4%) which influenced safe work behavior, health problems and knowledge in preventing GTS symptoms. High perceived barriers (36%) related to culture, understanding of the function of PPE, and availability of PPE. The reason tobacco farmers don't wear PPE is because they are uncomfortable with sweating and heat, so they don't use long-sleeved and water-repellent outerwear.</p>
A9	<p><b>Author:</b> Anita Dewi Prahastuti Sujoso,, Tri Martiana, Santi Martini. <b>Journal Identity:</b> Jurnal Berkala Epidemiologi, Volume 8, No (2). 2020.</p>	<p>The Overview Of <i>Green Tobacco Sickness</i> Among Tobacco Farmers In Jember District, Indonesia.</p>	<p>The case group included farmers who experienced GTS and the control group included farmers who did not experience GTS.</p>	<p>Journal used the reserch design used case – control methode.</p>	<p>Most of the respondents who positive suffer from GTS aged more than 45 years old, male, non-passive smoker, and had worked for &lt;18 years with Kasturi and Rajang leaf. On the other hand, the majority of respondents hose who are GTS negative are aged less than 45 years old, female, passive smoker, has worked for ≥18 years with Na Oogst and TBN leaves. The results of this study indicate that gender and nutritional status associated with incidence of GTS in tobacco farmers</p>
A10	<p>Sundar Muniswamy, steffi F Maliakel <b>Jounal Identity :</b></p>	<p>A Comparative Study on the Health Problems and</p>	<p>The sample size according to the above sampling is 210 tobacco growers</p>	<p>Cross Sectional study</p>	<p>On interpreting the scores of Fagerstrom Nicotine Dependence scale, 100% growers had</p>



ID Number	Author and Journal Identity	Journal Title	Population and Sample	Method	Summary of Result
	Indian Journal of Occupational and Environmental Medicine	Substance Abuse among the Tobacco Farmers and Non-Tobacco Farmers in Hassan District, Karnataka	and 210 non tobacco growers		some form of dependence on nicotine whereas only 89.5% of non-growers were nicotine dependent. 26.9% growers had high dependence on nicotine. The difference was statistically significant (p = 0.003)

Tobacco farmers are at high risk of experiencing *Green Tobacco Sickness* (GTS) because they are in contact with nicotine in tobacco and agricultural chemicals such as fertilizers and pesticides daily. Direct and long-term contact can cause acute nicotine poisoning through skin absorption. Nicotine absorbed by the skin will spread throughout the body through the blood (Permatasari et al., 2020). This will cause signs and symptoms of GTS such as dizziness, nausea, vomiting, dyspnea, pallor, and increased heart rate. Farmers can use the use of Personal Protective Equipment (PPE) for farmers to prevent exposure to pesticides on the body.

Based on the research results of Permatasari (2020), it was found that most respondents had good knowledge. The majority of respondents know what GTS is and the symptoms of GTS. Farmers use PPE to minimize exposure to pesticides or other chemicals and thus avoid associated health problems. However, when using PPE, most respondents did not know that wearing short sleeves could increase the risk of GTS symptoms. The results of the research study by Andriany et al. (2019) stated that tobacco farmers have a low level of education. Education will influence the workforce in efforts to prevent disease and increase the ability to protect health. The research study's results by Rokhmah et al. 2019 show that a low level of education results in shared knowledge about GTS. Tobacco farmers do not use PPE because they feel uncomfortable due to sweating and heat, so they do not use long-sleeved and water-repellent outer clothing. This

explains that education influences knowledge which will influence individual behavior.

Nicotine substances absorbed by the skin will enter into the blood plasma. Entry process, time of contact, and a person's susceptibility can affect the duration of the appearance of GTS symptoms. Factors influencing nicotine absorption are errors in using protective equipment when picking tobacco leaves. The use of personal protective equipment serves to prevent exposure to nicotine and pesticides, as well as prevent related health problems (Andriany et al., 2019). In the study of Sujoso et al. (2020), men have a higher risk than women. This result is not in line with research conducted by Park et al. (2018); the incidence of GTS in women is higher (55%) than in men (20%). Women workers dominate as tobacco farmers. Women do almost all work activities in tobacco farming. Exposure to occupational hazards can affect a woman's reproductive function if proper protective equipment is not used.

In the research study by Sujoso et al. (2020), nutritional status is related to the incidence of GTS. Normal and abnormal nutritional status is not related to the incidence of GTS. However, poor nutritional status causes individuals to be more susceptible to disease. Exposure to pesticides in tobacco farming causes genomic instability, making it more sensitive to nutritional intake and causing epigenetic changes. Alcohol consumption is not associated with the incidence of GTS. Individuals who consume alcohol or do not have the same risk of experiencing GTS. In addition, tobacco farmers also complain of nausea,

lack of appetite, shortness of breath, dizziness, and increased heart rate (Muniswamy and Maliakel, 2021). Based on age, at a young age, they have yet to be trained regarding awareness of exposure and sensitivity to nicotine (Park et al., 2018). In the research study by Fassa et al. (2021), there are individuals under 18 who are already working. The majority started working at the age of less than 15 years. Children and adolescents are especially vulnerable to exposure to chemicals because of the maturation of organ systems. Therefore, younger workers and non-smokers have a greater risk of experiencing GTS (Fassa et al., 2021).

The incidence of substance abuse by consuming alcohol is not associated with the incidence of GTS. In Muniswamy and Maliakel's (2021) study, it was found that farmers had a high alcohol drinking habit (55.07%). Individuals who consume alcohol or not have the same risk of developing GTS. Tobacco farmers who smoke were reported to have a nicotine dependence of 64.7% (Muniswamy and Maliakel, 2021). Factors that influence farmers to smoke and consume alcohol are stress and high physical work demands. Research by Fassa et al 2021 that workers who are often exposed and smokers can increase their tolerance to nicotine. However, this will increase the occurrence of health problems such as respiratory problems and heart disease.

In a research study by Campos et al. (2020), sun exposure, use of pesticides, and health status are related to the incidence of GTS. In comparison, peanut cultivation has no association with the incidence of GTS. Exposure to sunlight for a long time of 7 to more than 8 hours is at risk of experiencing GTS. The nicotine absorption process on the skin is facilitated by humid conditions and exacerbated by hot environments due to high transpiration. Cultivating peanuts using pesticides (organophosphates, triazoles, and pyrethroids) shows muscarinic manifestations similar to GTS (Campos et al., 2020).

Direct exposure to nicotine through the skin with leaves when tobacco harvesting causes GTS (Alves et al., 2020). Exposure to pesticides and nicotine together can increase DNA damage. This causes the emergence of specific symptoms of GTS with exposure to alkaloids. Higher

cotinine levels were found in the group exposed to nicotine. The study's results by Alves et al. (2020) showed no DNA damage related to plasma cotinine levels. Health education activities regarding Green Tobacco Sickness (GTS) must be done immediately to increase farmers' understanding (Adriani et al., 2021). Tobacco farmers are advised to raise awareness about using personal protective equipment. The use of personal protective equipment when working is beneficial for tobacco farmers to avoid GTS.

## CONCLUSION

Based on the research conducted, it was found that the incidence of Green Tobacco Sickness can be caused by a low level of Education. Some studies suggest that tobacco farmers have a good knowledge of what GTS is and the symptoms that can arise, but tobacco farmers have less knowledge about the importance of personal protective equipment (PPE) and do not know about the ability to protect health from the dangers caused by direct exposure to pesticides or chemicals used while working. Some studies also state that farmers use personal protective equipment (PPE), but tobacco farmers still use short-sleeved clothing when working, this is because tobacco farmers feel uncomfortable using long-sleeved clothing that can cause sweating and overheating. In addition to low education, poor nutritional status and direct exposure of the skin to nicotine are the causes of GTS. Although some studies suggest that nutritional status does not affect GTS, but poor nutritional status can make individuals more susceptible to disease, exposure to pesticides can cause genomic instability, making the body sensitive to the intake of certain nutrients. Direct exposure to the skin with nicotine can cause GTS, this is because nicotine that enters the skin can damage DNA so that GTS symptoms can appear specifically. As a nurse who has a duty to provide education, nurses can advise tobacco farmers to use good and correct PPE to avoid GTS by using gloves, masks, boots, long sleeves and waterproof clothing both when planting or harvesting tobacco.

## REFERENCE

Adriani, W., Anggriawan, R., Thoriq, M., Imani, A., & Wahyudi, A. (2021). Pendidikan

- Kesehatan untuk Mencegah Green Tobacco Sickness Pada Petani Tembakau. In *Jurnal Pengabdian Masyarakat Ipteks* (Vol. 7, Issue 1).
- Alves, J., Da Silva, F. R., Kahl, V., Reyes, J., Lima, E., Abreu, M. B., Thiesen, F. V., dos Santos, D. L., Salvador, M., dos Santos Branco, C., Nersesyanyan, A., Knasmuller, S., & Da Silva, J. (2020). Impact of nicotine-induced green tobacco sickness on DNA damage and the relation with symptoms and alterations of redox status in tobacco farmers. *Ecotoxicology and Environmental Safety*, 206. <https://doi.org/10.1016/j.ecoenv.2020.111397>
- Andriany, M., Cahyo, K., & Kusumawati, A. (2019). Hubungan Pengetahuan dan Persepsi Tentang Masalah Kesehatan Kerja dan Perilaku Penggunaan Alat Perlindungan Diri Petani Tembakau. *Jurnal Ilmu Keperawatan Komunitas*, 2(1): 1-7. <https://doi.org/10.32584/jikk.v2i1.299>
- Campos, É., da Costa, V. I. do B., Alves, S. R., Rosa, A. C. S., Geraldino, B. R., da Cruz Meira, B., Cunha, V., Cavalcante, T. M., Turci, S. R., Sarpa, M., & Otero, U. B. (2020). Occurrence of green tobacco sickness and associated factors in farmers residing in Dom Feliciano Municipality, Rio Grande do Sul State, Southern Region of Brazil. In *Cadernos de Saude Publica* (Vol. 36, Issue 8). Fundacao Oswaldo Cruz. <https://doi.org/10.1590/0102-311X00122719>
- Dewi, A., Sujoso, P., Martiana, T., & Martini, S. (2020). *THE OVERVIEW OF GREEN TOBACCO SICKNESS AMONG TOBACCO FARMERS IN JEMBER DISTRICT, INDONESIA* *Gambaran Kasus Green Tobacco Sickness Pada Petani Tembakau di Kabupaten Jember Indonesia*, 8, 181–189. <https://doi.org/10.20473/jbe.v8i22020>
- Fassa, A. G., Faria, N. M. X., Szortyka, A. L. S. C., Meucci, R. D., Fiori, N. S., & de Carvalho, M. P. (2021). Child labor in family tobacco farms in southern brazil: Occupational exposure and related health problems. *International Journal of Environmental Research and Public Health*, 18(22). <https://doi.org/10.3390/ijerph182212255>
- International Labour Organization. (2019). *Safety and health at work*. International Labour Organization.
- Kurniyawan, E. H., Rondhianto, Sulistyorini, L., Ardiana, A., Asmaningrum, N., Susanto, T., & Purwandari, R. (2023). *Buku Ajar Agronursing Pendekatan Asuhan Keperawatan pada Sektor Agroindustri* (1st ed.). KHD Production.
- Muniswamy, S., & Maliakel, S. (2021). A comparative study on the health problems and substance abuse among the tobacco farmers and non-tobacco farmers in hassan district, Karnataka. *Indian Journal of Occupational and Environmental Medicine*, 25(1), 33–38. [https://doi.org/10.4103/ijoem.IJOEM\\_41\\_20](https://doi.org/10.4103/ijoem.IJOEM_41_20)
- Park, S. J., Lim, H. S., Lee, K., & Yoo, S. J. (2018). Green Tobacco Sickness Among Tobacco Harvesters in a Korean Village. *Safety and Health at Work*, 9(1), 71–74. <https://doi.org/10.1016/j.shaw.2017.06.007>
- Permatasari, V., Budi Musthofa, S., Nugraha Prabamurti Promosi Kesehatan dan Ilmu Perilaku, P., & Kesehatan Masyarakat, F. (2020). *FAKTOR YANG BERHUBUNGAN ANTARA PERILAKU PENCARIAN PENGOBATAN GEJALA GREEN TOBACCO SICKNESS (GTS) DENGAN PETANI TEMBAKAU DI KECAMATAN BANSARI KABUPATEN TEMANGGUNG*, 8(2). [http://ejournal3.undip.ac.id/index.php/jkmRokhmah, D., Ma'Rufi, I., & Khoiron. \(2019\). Incidences of Green Tobacco Sickness \(GTS\) on tobacco farmer and prevention efforts through social capital utilization in Indonesia. \*IOP Conference Series: Earth and Environmental Science\*, 243\(1\). <https://doi.org/10.1088/1755-1315/243/1/012090>](http://ejournal3.undip.ac.id/index.php/jkmRokhmah, D., Ma'Rufi, I., & Khoiron. (2019). Incidences of Green Tobacco Sickness (GTS) on tobacco farmer and prevention efforts through social capital utilization in Indonesia. IOP Conference Series: Earth and Environmental Science, 243(1). https://doi.org/10.1088/1755-1315/243/1/012090)