2021年度
大学院理工学研究科【環境共生工学専攻】博士後期課程
一般選抜試験(第Ⅱ期)問題

英　　語

開始時刻　午前10時00分
終了時刻　午前11時00分

【注意事項】

1．答案用紙には、氏名を必ず記入してください。
2．配布された答案用紙は試験が終了したら、必ず提出してください（問題用紙は提出しなくてよい）。

1 次の文章を読んで以下の問いに，本文に基づいて日本語で答えなさい。なお，固有名詞・technical terms 等で必要であれば英単語のまま表記しても構わない。

A single-shot coronavirus vaccine made by Johnson & Johnson is 85 percent effective at preventing severe disease and death, even against new variants of the virus, the company announced in its interim analysis January 29.

The vaccine didn't fare as well at preventing more moderate cases of COVID-19, particularly in Latin America and South Africa, where variants that spread more easily have arisen. Depending on location, the shot was only 72 percent to 57 percent effective against moderate to severe bouts of the illness.

Other vaccines, particularly the two mRNA vaccines that have emergency use authorization in the United States, have reported levels of overall efficiency of up to 95 percent against the coronavirus. That discrepancy could make people reluctant to accept a less effective vaccine, Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases, said during a Jan. 29 conference call about the results. It shouldn't, he added.

"If you walk up and say, 'Well, go to the door on the left and you get 94 to 95 percent [effective vaccine]. Go to the door on the right and get 72 percent.' What door do you want to go to?'" But what people need to understand, he said, is that real importance of the vaccine is keeping people out of the hospital and preventing the most severe complications of the disease.

That's what the new vaccine does, Mathai Mammen, global head of research and development for Janssen, Johnson & Johnson's pharmaceutical division, said during the news conference. "We can prevent COVID, in many cases," he said. "We can prevent hospitalization. In those that that contract COVID and have moderate disease, [they] have a milder course of disease. Nobody doesn't benefit from this vaccine."

Johnson & Johnson's vaccine uses a common cold virus — adenovirus 26 — that has been altered so that it can't replicate in the body to cause disease. The adenovirus ferries instructions for making the coronavirus's spike protein into human cells. Human cells then make the spike protein, triggering the immune system to produce antibodies and fire up cellular immune defenses from T cells, which attack the coronavirus should it be encountered later.

The company has used this adenovirus system to make an Ebola vaccine as well as still-experimental vaccines against Zika, HIV and respiratory syncytial virus, or RSV. Using adenoviruses as carriers, or vectors, has also been used for COVID-19 vaccines made by the University of Oxford with AstraZeneca, the Canadian-Chinese company CanSino, and for the Russian Sputnik V vaccine.

Johnson & Johnson tested their vaccine in 44,325 adults in Argentina, Brazil, Chile, Colombia, Mexico, Peru, South Africa and the United States. Among the participants, 468 cases of COVID-19 arose, the company and U.S. National Institutes of Health each reported in news releases.

Deaths occurred in the placebo group, but none in the vaccine group. But the company declined to give specific numbers of cases and deaths in both groups until it files for emergency use authorization with the U.S. Food and Drug Administration. That filing could come next week.

Effectiveness against moderate to severe disease varied by region, ranging from 72 percent in the United States to 66 percent in Latin America to 57 percent in South Africa. Overall, the vaccine is 66 percent effective at preventing moderate to severe disease. The vaccine was similarly effective in young adults and people 60 and older, and for people with and without underlying health issues, such as obesity, type 2 diabetes and other conditions that increase the risk of complications from COVID-19.

At first glance, the declining effectiveness in Latin America and South Africa might appear discouraging, Mammen said. More transmissible variants of SARS-CoV-2, the coronavirus that causes COVID-19 have been discovered in Brazil and South Africa.

The South Africa variant, known as either 501Y.V2 or B.1.351, has been causing particular concern because of both its increased transmissibility and ability to evade some antibodies that provide protection against the coronavirus. But the vaccine protects against the most severe consequences of the disease even against those variants, Mammen said. "Not a single South African after 28 days post-vaccination ended up needing to go to the hospital. No South African died that was vaccinated."

The other companies ran their studies at a different stage of the pandemic before the new variants appeared, so the numbers aren't really comparable, Mammen said. "The pandemic has changed." Now, "the majority of cases are coming from an evolved set of viruses."

Novavax, a Gaithersburg, Md.–based company, announced January 28 that its protein-based vaccine prevents illness with 89 percent effectiveness, but was also less effective against the South Africa variant. The same day, officials in South Carolina announced that two unconnected people with no history of travel had contracted the South Africa variant. That finding probably means the variant is circulating undetected in the state and elsewhere in the country.

Despite lower efficacy, Johnson & Johnson's vaccine has some advantages over the mRNA vaccines. It is given in a single shot instead of two, so it can vaccinate twice as many people with the same number of doses. It needs to be refrigerated, but not frozen the way those vaccines do. And the vaccine has milder side effects than the already authorized Moderna and Pfizer vaccines. Some people had fever, fatigue or pain at the injection site after inoculation, but "the vast majority of people felt nothing at all," Mammen said.

(https://www.sciencenews.org/article/covid-19-coronavirus-vaccine-johnson-and-johnson-results-variants より一部抜粋・改変)

(1) Johnson & Johnson のワクチン（以下，このワクチン）はどの程度有効であるといっているか。
(2) このワクチンのメリットとデメリットを列挙せよ。
(3) このワクチンの安全性についてはどのようにいっているか。
(4) 最近新たに発見された南アフリカ変異株とはどのようなものであって，このワクチンのこの変異株に対する有効性としてどのような説明がなされているか。
(5) アデノウイルスをベクターとするワクチンはどのようなものであると説明しているか。またその特徴はなにか。

2 次の文章を（日本語で）要約しなさい。なお，固有名詞・technical terms 等で必要であれば英単語のまま表記しても構わない。

New research has revealed how an invasion of the alien evergreen tree, *Prosopis juliflora* seriously diminishes water resources in the Afar Region of Ethiopia, consuming enough of this already scarce resource to irrigate cotton and sugarcane generating some US$ 320 million and US$ 470 million net benefits per year.

A team of Ethiopian, South African and Swiss scientists, including lead author Dr Hailu Shiferaw, Dr Tena Alamirew, and Dr Gete Zeleke from the Water and Land Resource Centre of Addis Ababa University, Ethiopia, and Dr Sebinasi Dzikiti from Stellenbosch University, South Africa, and Dr Urs Schaffner, Head Ecosystems Management, CABI, have been assessing water use of prosopis and its impacts on catchment water budget and rural livelihoods in the dry Afar Region of Ethiopia, since 2015 as part of a long-term collaboration in the framework of the CABI-led Woody Weeds project.

Their new study, published in Scientific Reports, provides evidence that this alien tree, which has invaded both the floodplains of the Awash River and the surrounding dryland habitats, uses excessive amounts of water by consuming approximately 3.1-3.3 billion m3/yr of water throughout the year in the Afar Region.

Dr Shiferaw said, "We found that single trees of the evergreen prosopis consume between 1-36 liters of water per day, depending on stem diameter and site conditions. Prosopis trees not only use water throughout the year, but even consume more water during the dry season, when almost all native plants have shed their leaves. The high sap flow of prosopis in the drylands throughout the year may be due to exceptionally deep roots that penetrate up to 50 m below the surface, where they tap into groundwater that cannot be used by native trees with shorter roots."

In the context of climate change and an increasing frequency of drought events in dry regions of Sub-Saharan Africa, the report concludes that this invasive tree is likely to have serious consequences for sustainable livelihoods in the region unless its spread is contained and its density reduced.

Dr Urs Schaffner, senior author and Head Ecosystems Management at CABI in Switzerland, said, "Since its introduction in the Afar Region in the 1980s, prosopis has invaded 1.2 million ha of land. Thus, unless the spread of prosopis is contained and the density reduced in areas where it has become established, this invasive tree is likely to have serious consequences for sustainable livelihoods in the region. The estimated net benefits from water savings alone would strongly justify the implementation of a coordinated control programme."

The report clearly supports findings from work undertaken in South Africa on water use by invasive tree species. Prof Brian van Wilgen from Stellenbosch University, South Africa, previous scientific

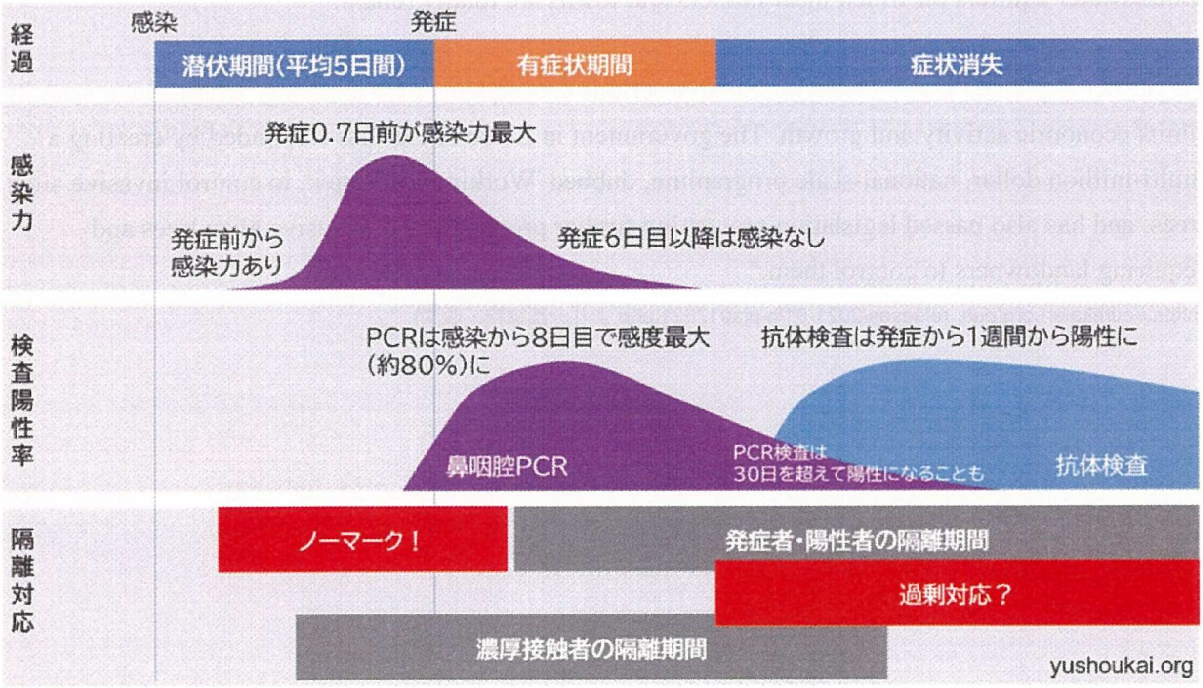
advisor to the 'Working for Water' programme in South Africa and partner of the Woody Weeds project, said, "In South Africa, invasive alien trees are estimated to reduce surface water runoff by between 1.5 and 2.5 billion m3 per year, and this could increase substantially as the invasions continue to spread. In addition, invasive trees in drier parts of the country have substantially reduced water in groundwater aquifers on which local farmers and towns are totally reliant."

He further explained that, "These losses have serious consequences for a country where water scarcity limits economic activity and growth. The government in South Africa has responded by creating a multi-million dollar, national-scale programme, dubbed 'Working for Water', to control invasive alien trees, and has also passed legislation preventing further propagation of invasive alien trees and requiring landowners to control them."

(https://eurekalert.org/pub_releases/2021-01/c-pja012621.php より一部抜粋・改変)

3 Answer the questions below in English.

1. Describe what facts are displayed in the figure, in details.
2. Give discussion on the facts or implications given in the figure.



(https://www.koureisha-jutaku.com/wp-content/uploads/IMG_1825.png)