

All the words marked in red are likely to be tested.

Growing Brighter

1 From the outside it looks like a tall, metal-clad barn. But step in, through a large airlock



designed to keep out the bugs, and a kaleidoscopic (This picture is kaleidoscopic.

The word denotes a tube-shaped optical instrument that is rotated to produce a succession of symmetrical designs. What do we call it in Chinese? In this text, the kaleidoscopic scene refers to the different colours of LEDs constantly changing.) scene emerges. A central aisle is flanked by



two pairs of towers. Each tower is stacked(What is stack? This is stack:

like a stack of documents, a stack of paper money. Stack as a verb is “to arrange in a stack.” What can be arranged in a stack? Books, piles of hays, cartons and trays.) with a dozen or so trays on which are growing strawberries, kale, red lettuce and coriander. And each tray is bathed in vibrant light of different colours, mostly hues of blue and magenta. Douglas Elder, who is in charge of this artificial Eden(人造伊甸园), taps some instructions into an app on his mobile phone and, with a short whirr(whirr is a vibrating or buzzing sound of a mechanical device. It is a British spelling. The American spelling is whir. This word will not be tested in the quiz.) of machinery, a tray of lush, green basil slides(What’s the difference between slide and slip? When you slip, you would accidentally slide. So slide is the concrete action of your slip.) out for his inspection.

2 Mr. Elder is product manager for Intelligent Growth Solutions (IGS), a “vertical farming” company based at Invergowrie, near Dundee, in Scotland. Each of the nine-meter-high towers in the demonstration unit that he runs occupies barely 40 square meters. But by stacking the trays one on top of another(The underlined phrase can be paraphrased as “trays are scaled up”) an individual tower provides up to 350 square meters of growing area. Using his phone again, Mr. Elder changes the colours and brightness of the 1,000 light-emitting diodes (LEDs) strung out above each tray. The app can also control the temperature, humidity and ventilation, and the hydroponic system that supplies the plants, growing on various non-soil substrates, with water and nutrients. Armed with his trusty phone, Mr. Elder says he can run the farm almost single-handedly.

Plant power

3 Vertical farming of this sort is not, of itself, a new idea. The term goes back to 1915, though it took a century for the first commercial vertical farms to be built. But the business is now taking off. SoftBank, a Japanese firm, Google’s former boss Eric Schmidt and Amazon’s founder Jeff Bezos have between them(What’s the meaning of “between” here? Jeff and Bezos have invested \$200 between them to run the base. In this sentence, the word “between” involves a sense of cooperation. They have between them invested... means they invested the farm through their combined effort.) ploughed(This verb usage is extraordinary. The author substitutes the verb

“invest” with a more vivid and robust verb of agriculture – “plough”.) more than \$200m into Plenty, a vertical-farming company based in San Francisco. And in June Ocado, a British online grocery, **splashed out**(Likewise, the author replaces “spend” with “splash out”. **Splash out means to spend extravagantly.**) £17m (\$21.3m) on vertical-farming businesses to grow fresh produce within its automated distribution depots.

4 The interest of investors is growing just as technology promises to turn vertical farming operations into efficient “plant factories”. The high-tech LEDs in IGS’s demonstration unit are **optimized** so that *nary a (= not a. It will **not** be tested)* photon is wasted. The hydroponics, and the **recycling** that supports them, mean the only water lost from the system is that which ends up as part of one of the plants themselves. And towers mean the system is **modular**(**Something modular indicates that it is easy for assembly and disassembly.**), and so can be **scaled up**(=stack). Most of the systems which IGS hopes to start delivering to customers early next year will consist of ten or more towers.

5 Some people, however, remain **skeptical**(Both **skeptical** and **sceptical** are ok. It denotes a doubtful attitude, like a **skeptical smile**, a **skeptical promise**.) about how much vertical farms have to offer that good-old-fashioned greenhouses do not. Vertical farms are certainly more compact—a bonus in places like cities where land is expensive. Since sales of fresh produce to the urban masses are often touted as one of vertical farming’s biggest opportunities, that is important. But a greenhouse gets its light, and much of its heat, free, *courtesy of*(=thanks to. It will **not** be included in the quiz) the sun. And modern greenhouses can also use solar-powered **supplementary**(Note that the differences among **supplement**, **complement** and **compliment**.) LED lighting to **extend** their growing seasons and hydroponic systems to save water, says Viraji Puri, co-founder. of Gotham Greens, an urban-farming company that operates greenhouses on the roofs of buildings in New York and Chicago. As for food miles, they could not get any shorter for Gotham Greens’s rooftop greenhouse in Brooklyn, which supplies the Whole Foods Market located downstairs.

6 The biggest drawback of vertical farming is the high cost of the electricity required to run the large number of LEDs. This has meant that production has been commercially **viable**(**Viable means feasible, capable of success, or operational, like a viable plan, meaning a plan which is feasible or practicable.**) for high-value, **perishable**(The verb form of **perishable** is **perish**. **Perish** means vanish, disappear, wither 枯萎. The suffix **-able** means something that is likely to do, so something that is likely to perish is **perishable**.) produce only, such as salad leaves and herbs. That, nevertheless, is a market not to be **sniffed at**(**Sniff at originally means to express your contempt or dislike for something. In the context, the market is not to be sniffed at indicates the importance or the potential of this kind of farming.**). But for a broader range of produce, it can prove too expensive. In 2014 Louis Albright, an emeritus professor of biological and environmental engineering at Cornell University in America, calculated that a loaf of bread made from wheat grown in a vertical farm would be priced at about \$23.

Blue is the colour

7 One way of saving electricity is to use LEDs that generate only the colours that plants require, instead of the full spectrum of plain white light. Plants are green because their leaves contain

chlorophyll, a pigment that reflects the green light in the middle of the **spectrum** while absorbing and using for **photosynthesis** the blue and red wavelengths at either end of it.

8 The vertical farm at Invergowrie takes this idea further. It uses LEDs that are highly **tuneable**(It can be written as **tunable**. “A tune” is a song or a musical tone 音调. So “tuneable” means that a musical tone can be tuned or changed. 同学们弹过乐器吗，尤其是古筝、扬琴等。当音阶不准的时候，我们可以用手调整 We can tune it.). Although the lights produce mostly blue and red wavelengths, researchers now know that other colours play an important role at various stages of a plant’s development, says David Farquhar, IGS’s chief executive. A dose of green at an appropriate moment produces a higher yield. A timely spot of infrared can improve the quality of foliage. The lights can also produce various blue/red mixes.

9 To operate these LEDs **efficiently**, the company has developed a low-voltage power-distribution system. This, says Mr. Farquhar, can cut energy costs to about half of those **incurred** by existing vertical farms. As a result, all four towers can produce 15-25 tons a year of herbs, salad leaves, fruit, and vegetables. This, the company claims, is between two and three times more than a **conventional** greenhouse with an equivalent but horizontal growing area, and **equipped with supplementary** lighting and heating, could manage. And the system can grow all this produce at a similar cost-per-kilogram.

10 One of the jobs of the Invergowrie unit is to develop lighting regimes tailored to individual crops. Another is to develop algorithms to control, in an equally **bespoke** way, the **climatic** conditions preferred by different crops. The idea is to design crop-specific weather “recipes” in order to boost the yield and quality of whatever varieties are grown in the vertical farm. All the processes involved are **engineered**(Look up the verb in a dictionary. Clip the link and think it over. <https://www.thefreedictionary.com/engineer>) to be efficient. **Irrigation**, for instance, relies on **captured** rainwater. This is cleaned and recycled, but only 5% gets used up by each harvest—and most of that as the water-content in the plants themselves. Ventilation is also a closed loop, harvesting surplus heat from the LEDs while managing humidity and oxygen levels.

11 By reducing running costs, the system should make it profitable to grow a wider variety of produce vertically. The firm has already succeeded with some root vegetables, such as radishes and baby turnips. Bulk field crops, such as wheat and rice, may never make sense for a vertical farm, and larger, heavier vegetables would be **tricky** to raise. This means full-grown potatoes are probably off the menu, at least with existing technology.

12 Seed potatoes, though, are a good candidate, says Colin Campbell, head of the James Hutton Institute, a plant-science research center backed by the Scottish government. It is based next door to IGS and works with the company. Many fields around the world, Dr Campbell observes, are suffering a growing burden of pests and disease, such as potato-cyst nematode. In the controlled environment of a vertical farm, from which both pests and diseases can be **excluded**, seed potatoes could be **propagated** more efficiently than in the big, bad outdoor world. This would give them a head start when they were planted out in fields.

13 The institute's researchers are also looking at plant varieties that might do particularly well indoors, including old varieties passed over in the search for crops which can **withstand** the **rigors**(Why is the word written in plural form?) of intensive farming systems. By **dipping into** the institute's gene banks, Dr Campbell thinks it may find some long-forgotten fruits and vegetables that would **thrive** in the security of a vertical farm.

14 All this could go down well with foodies, and **unlock** new and forgotten **flavors**. Shoppers might even find some **exotic** varieties growing in supermarket aisles. In Berlin a company called Infarm provides remotely controlled shelved growing cabinets for shops, warehouses, and restaurants. Herbs and salad leaves, including **exotics**(Why is the word written in plural form?) such as Genovese basil and Peruvian mint, are resupplied with seedlings from the company's nursery as the mature plants are picked.

15 Vertical farming then will not feed the world, but it will help provide more fresh **produce**(A typical agricultural word.) to more people. It may even be that, as vertical-farming systems improve further, **miniature** versions will be designed for people to put in their kitchens— thus proving that there is nothing new under either the sun or the LED. Such things used once to be called window boxes.