1. We at Mumbai (Bombay,India) use the compressed air directly in the spectrometer without drying(!), even though we have high humidity here of 80 to 85%. We have installed automatic water remover by a solenoid to the compressor tank, which removes water accumulated in the tank every 10 minutes and so far it is working without much of problem.

2. Compressed air has a Relative Humidity much higher than the ambient pressure air. R.H. of 100% is very common in compressed air, so even in dry weather you will need an air dryer.

3. We have 3 NMR spectrometers (600MHz and two -- 400 MHz) each with the following "UHP Dry Gas Generator" available from ParkerBalston. Here is the link to the product:
http://ph.parker.com/us/17053/en/ultra-dry-gas-generator

4. We are not in the Rockies, but in Tucson I think we know a thing or two about dry air. We use Whatman model 64-20 dual dessicant column air dryers on all our instruments that have air chillers (Bruker BCU). Even with this dryer (and a number of pre-filters to remove liquid water from the air) we still have ice blockage in our air chiller once or twice a year. This happens during our monsoon season (late summer) or during prolonged winter rainy periods. If your are not using an air chiller you have a much less challenging situation for air drying.

5. Have you considered using the nitrogen gas from high pressure L-N2 dewar to support your new 500? This will eliminate the need for an air dryer, as well as providing larger temperature range for VT experiments. If your new 500 is from Bruker-BioSpin, their probes (for > 500 MHz systems) do perform better using N2 gas. I use two 230L high pressure L-N2 dewars (with auto-switching manifold) to support one 600 with CryoProbe. Each dewar could last 6 – 7 days under normal use, and I have never had system shutdown due to compressor Problem. I also use the same N2 gas from the 230L dewar for low temperature work (-10C to –80C) on my 500. Hope this info helps.

6. This will depend on your applications and how much you want to be prepared for future more demanding applications. The low temp VT work will need something. Sometimes a $500 wall tube type is enough for work at 4C. You need this at a minimum and if you're like me, you want a prefilter/bulb to catch the odd particulate, water overload, or oil drop… Depends on the dryer and filter at the compressor. If you really need a -40C dewpoint for work around -10 - -20C, they are about $1500 (bigger cartridge, Parker-Balston is good). If you need -100 dewpoint for below -40C, it can run $4-7k and then you need a

ballast tank to keep the sample from bumping up when they cycle between cartridges.
There are lots of folks with more expert opinions here but that's my 2 cents…

7. We have a Parker Balston UDA300 and have been pretty happy with it. Previously I had a Hankisson air dryer and that was great but more expensive. If you're running on house air you want at least a filter in line in case the water trap on the air compressor fails. Both at my current and previous position, the water traps have failed and water and sludge backed up into the instruments causing major damage and weeks to months of down time. Luckily I wasn't in charge when it happened! Being in an arid environment this might not be a big problem but I wouldn't take a chance. Otherwise the only reason you would need an air dryer is if you're using chilled air for cold temperature runs and you need to reduce the dew point. If you're using N2 boil off then you wouldn't need it.

8. We use a N2 generator here, and that works pretty well. When I was in Boulder, we used N2 gen for the 800 but a drier system for the other instruments. The dry, Rockies air tends to be a good starting place (and I miss my mountain views). But anyway…
   I've known and worked in several labs that all have had pretty good luck with the large-ish twin tower Balston system (which is now part of Parker-Hannefin IIRC). It's about 18" wide, 12" deep, and 3' tall or thereabouts, usually gets mounted to a wall, doesn't require all that much maintenance. and gets a dew point between -80 and -100 degrees. It's quiet EXCEPT for when it switches, so you ideally want to keep it in a closet, mechanical room, etc. You already have compressors, and right next to those will probably work.
   The following apply to both air driers and N2 generators:
   1. The switching kind tend to have some pressure fluctuation when they switch, so it's a good idea to have at least a small ballast tank between then and your instruments to even it out. 30 gallons capacity is probably sufficient for this and not very large. We actually have a much larger tank which provides us 15-20 minutes of nearly full pressure if our system goes out, say due to a power outage.
   2. I already mentioned it, but they're loud enough that you probably want them not in your main workspace. Fortunately, air hoses are relatively cheap and easy to run.
   3. A refrigerated pre-drier after your compressor helps, they usually dry the air to -20 degree dew point.
   4. Both types of systems are hungry for air. To get around 3 CFM output, you'll need at least a constant 12-15 CFM input at a slightly higher pressure, so you need to size your compressor accordingly. I've seen several reciprocating type compressors literally burn up. Recips can be made to work if you're very careful, but a rotary screw-type air compressor really is the best bet. You will want to install an oil mist filter between a screw compressor and anything downstream though.

9. I asked AMMRL some years ago for comprehensive insights on air dryers and compressed air systems. You'll probably find it useful: http://www.joshkurutz.com/home/AMMRL_files/AMMRL_AirSystmSummary_110206.txt
   In general, an air dryer is absolutely essential for doing any sort of VT work. If any part of the line gets colder than 0 °C, it's at risk for freezing up and blocking airflow, which can get really nasty. The dryers aren't that expensive and they tend to last a very long time. You should also consider getting a ballast (a big tank) in which to feed air coming from the dryer. This will damp out vibrations and noise associated with switching desiccant cylinders in the dryer.

10. Answer is "it depends" (isn't that usually the case?). I operate a 300, 400, & 500 using house compressed air with DX & BX particle filters, after separators with auto-drains, and moisture detectors in line (no air dryer at all). This is because our house air is "pretty good" and uses refrigerated air dryers on the back side of the massive screw compressors used to supply the house compressed air. Remember that with compressors the air gets very hot, allowing the air to absorb much more moisture (i.e. relative humidity vs. dew-point vs. temperature plot). So, if your relative humidity is 5% , and you compress (and heat) that air to a HOT 5% relative humidity, then cool it down to room temperature, you just made 50% relative humidity air. Ultimate answer, it mostly depends on who is running your air compressor, and is the air coming out of it reasonably dry.
    Second case is whether you are using refrigerated air-cooling (i.e. an FTS or the Bruker BVT—equivalent), which allows you to lower the VT-gas via the FTS Chiller. These cool the air to something like -60C, and if you don't have REALLY dry air (i.e. dew point below the refrigerator temperature) you will iced it up and flow will stop. We use Parker/Balston twin-tower desiccant air dryers for these instruments (on all of our biomolecuar instruments). Caution that you need a big ballast tank after the air dryer to absorb/dampen pressure fluctuations when the tower swaps sides to purge one tower while the other is being used. We've seen artifacts due to this, especially when using a ColdProbe (Varians) very sensitive to any vibration/fluctuation.
    For my small-molecule instruments, I switch to 100% Dry Nitrogen when doing Low-temp NMR (using LN2 as the coolant in a heat exchanger or evaporator), so I don't need a desiccant dryer on these systems.
    Bottom Line Summary: Bio-Instruments with refrigerated (FTS) air chillers for sample temp: Super dry using desiccant and/or N2 purifiers (on our 800MHz & 900 MHz). One of my routine 400s shares air with two bimolecular instruments, so it get's a free ride of dried air, but otherwise my small molecule (and solid-state) spectrometers use filtered air with moisture indicators in line… no additional drying.

11. I used a Balston model 75 for years. Then the whole building got a magnificent big compressor and dryer. Beware converting to this. There was

an outage and all the water in the air pipes 1,2,3, and 4 stories up drained into the basement and when the compressor was restarted, it all got pumped into my facility. After the cleanup, physical plant installed elaborate water-reject equipment to protect me from future incidents. You may have the option of buying a dryer yourself or paying physical plant to buy it and install it just for you. I recommend the latter - then they have to maintain it.